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Readers may be interested to know that THE CENTENNIAL REVIEW has been selected among American periodicals to be exhibited at the American Pavilion in the Brussels World's Fair, and that copies of the issues of Spring and Summer 1958 will be on sale there.

MIGUEL DE UNAMUNO

John Upton

(In this and the following issue, THE CENTENNIAL REVIEW presents two new translations from the work of Miguel de Unamuno. Both are from his collection of essays entitled SOLEDAD. In this issue is a translation of the principal essay "Soledad"; the other will be "¿Qué es Verdad?". The translations are based on the edition of SOLEDAD published in Buenos Aires by Espasa-Calpe Argentina S. A., 1946, and are authorized by the literary executors of the author.—Editor)

"THIS DONQUIXOTIC don Miguel de Unamuno, this severe Basque," as the poet Antonio Machado has called him,¹ was born at Bilbao September 29, 1864. It might well be said that the philosopher was a Spaniard only by political accident: the Basque provinces of Vizcaya, Álava, and Guipúzcoa relinquished their autonomy and officially became part of Spain twelve years after his birth. After taking his doctorate in philosophy and literature, he was appointed in 1892 to the chair of Greek studies at the University of Salamanca, where he was active as professor and rector for nearly three decades. His increasingly outspoken political views—those of a passionate patriot watching with mounting alarm the growing power of the army in Spain—eventually earned him the displeasure of General Primo de Rivera's military directorate, and in 1924 he was exiled to the Canary Islands.

"When Napoleon's troops invaded the Motherland," he had written some years before, "the entire populace rose in arms and fought, each in his own way, against the enemy. It was a whole nation up in arms. The spirit that moved the

¹ *Elogio a don Miguel de Unamuno.*

heroes of Bruch and Gerona has not died; but if the army comes to be the dictator of patriotic sentiment, determining its direction and meaning and imposing upon it its sacrosanct dogmas, we may arrive at such a state of coercive pseudo-patriotism that in the face of another such invasion the people will fold their arms and say: 'You are the Motherland; defend yourselves!' "²

Scorning the amnesty which was later offered him by the Spanish government, he took up residence in Hendaye, just across the Franco-Spanish frontier from his native provinces. Toward the end of his life he returned to Salamanca, where he died while under virtual arrest in his home on December 31, 1936.

A voracious reader in all modern and ancient literatures, and an indefatigable writer—he produced a torrent of philosophy, essays, novels, criticism, memoirs, and poetry, of which at least some thirty volumes are still in print—Unamuno evinces, with his fellow Basques Ignatius of Loyola and Pío Baroja, the fierce self-respect, stubborn conservatism, and mistrust of civilization that are peculiar to his race. He is moved to eloquent fury by formal logic, public art, practitioners of the law, bullfights, Spanish literature as a whole ("simply insupportable"), and *acedia*.

The *summum bonum* of his exalted, highly personal mystic philosophy is the redemption of the joyous lyric poet innate in every man.

"I have no idea of what many of the notions that come to my mind mean," he says. "There is someone within me who dictates them. I obey him without going inside to see his face or ask his name. I know only that if I should see his face and he should tell me his name, I would die so that he might live."³

Of his longer works, the most characteristic are *The Life*

² *La Patria y el Ejército*.

³ *El Sepulcro de Don Quixote*.

of *Don Quixote and Sancho* (1905) and *The Tragic Sense of Life* (1913). Both have been translated into English.

In his *Elogio* to "the gigantic Iberian Miguel de Unamuno, because of whom present-day Spain has some eminence in the world," Antonio Machado concludes:

"He is as good and better than Loyola:

He tastes of Christ and spits on the Pharisee."

SOLITUDE

Miguel de Unamuno
Translated by John Upton

IF I FLEE from him, you may be sure it is because of the love I bear him. By avoiding him, I seek him. When he is with me, and I see his face and hear his voice, I should like to blot out his glance and strike him mute for ever; but then when I leave him and am alone with myself, in the dark abyss of my consciousness I see two wavering points of light like twin stars in the fathomless darkness, and in the silence I hear distant, muffled sounds from out of the infinite, which never seem quite to reach me. They are his eyes; they are his words: his eyes purified by absence and distance, his words cleansed by his stillness. And this is why I flee from him in order to find him, and why I avoid him because I love him.

When love is pure and noble, it grows with distance. I feel his soul nearest me when his body is far away. When he departs, he leaves me his soul in his words and in his glance; and he himself lives and grows within me.

My love for the crowd is what drives me to avoid it. By running from it, I try to find it. Don't call me a misanthrope. Misanthropes search out company and conversation; they need other human beings to nurture their hate or contempt. Love can live on memories and hope; hate needs the reality of the moment.

Then let me fly from society and take refuge in the tranquillity of the fields, finding the companionship of men there in my soul.

Men feel themselves to be truly brothers only when they listen to one another in the silences, in solitude. Your poor

neighbor's half-suppressed cry of pain strikes more deeply into your heart when you hear it through the wall that separates you, than would all his weeping if he were standing before you. I shall never forget a night I spent at a bathing resort when I was kept awake until dawn by a faint, periodic sobbing, a muffled flood of tears, as though the sufferer were trying not to disturb those sleeping about him; a soft, discreet weeping that came to me from the next room. That grief—whose it was I never knew—had lost all personality; I began to believe that it sprang from the stillness of the night itself, that it was the night that was grieving; for a moment I even wondered if it came from the depths of my own soul.

The next day I left with no attempt to learn who my suffering neighbor was, or the source of his sorrow. I think I have never pitied another human being so much.

Only solitude can melt that thick crust of modesty that isolates us one from the other; only in solitude can we find ourselves; and when we find ourselves, we find in ourselves all our brothers in solitude. Believe me, society separates us just as solitude unites us. If we do not know how to love each other, it is because we do not know how to be alone.

Only in solitude, when the shell that shuts us off from each other and from God is dissolved, can we have no secrets from God. Only in solitude can we raise our hearts to the level of the Heart of the Universe. Only in solitude can the redeeming hymn of supreme confession spring from our soul.

There is no truer dialogue than that which you strike up with yourself; and it is a dialogue that can be uttered only if you are alone. In solitude and only in solitude can you know yourself as a neighbor; and as long as you do not know yourself as a neighbor, you will never be able to see in your neighbor another self. If you want to learn to love the minds of others, withdraw into your own.

Why converse with the rest? There are no real dialogues, because the conversations which fit that description are those

which are not worth remembering. Almost all of what we call dialogue, when it is lively and leaves us with an imperishable memory, is nothing but interwoven monologue. You interrupt your monologue from time to time so that your interlocutor can resume his; and when he breaks off his monologue, you take up yours again. Thus it is and thus it should be.

Thus it should be. It would be better if all our speech were monologic—a dialogue with God, in which we prayed day after day and minute after minute, each his own litany, so that our several prayers would mingle into one as they ascended heavenward, and would reach His eternal and infinite ears as a single orison. It would be the perpetual monologue of poor afflicted humanity. And from the bosom of God the prayer would return to us; the voice of God in our hearts, echoing the peaceful silence, is only the voice of the centuries and the utterance of man. Our inner life, our life in solitude, is a dialogue with all men.

In the same way, the humble flower that vaporizes and returns aloft the dew that has fallen upon it from the sky receives again in exchange a celestial drop of the liquor that has risen heavenward from all the flowers.

You accuse me of taking no interest in the anxieties of mankind. The truth is exactly the contrary. I am convinced that there is only one anxiety, one alone and the same for all men; I never feel this more deeply than when I am most alone. Every day I believe less in the social question, the political question, the aesthetic question, the moral question, the religious question, and all the other questions men have invented in order to avoid facing squarely the one real question: the human question, which is mine and yours and everybody's.

Since I know that you are going to say I am playing with words, and are going to ask me what I mean by the human question, I shall have to tell you once more: the human question is the question of what is to become of my consciousness,

yours, the other man's, everybody's, when each of us dies. Any consideration that does not face this question is simply a noise we make to keep from hearing ourselves. This is why we live in such dread of solitude and seek the company of other men.

We pursue society only to escape from ourselves; and since each of us is avoiding himself, those who join together in social intercourse are only empty shadows and miserable specters. When they are together, men discuss only their fears and anxieties, emptying themselves; thus they are never more alone than when they are gathered together, and are never more together than when they are apart.

If you only knew how much I owe to sweet solitude! If you only knew how my affection for you has grown there; and how the words you pour into my soul in the brief hours of our interviews become sweeter and more important there, growing sweeter because of their deeper meaning and taking on meaning because of their growing sweetness!

When you speak to me, your voice crashes in my ears and breaks the continual monody of my thoughts; your face gets in the way between my eyes and the familiar shapes they are regarding. But as soon as you have gone, your words come back to me, this time from the depths of my own being, incorporated into the chant of my own thought, beating in the same rhythm like an accompaniment. And behind your voice appears your so familiar face, softened by the undying distance.

Go to solitude, I beg you; for the love of God, isolate yourself. Isolate yourself, because for a long time I have been wanting to talk with you alone.

Men concern me so, and my heart beats so heavily when I hear their perennial cries of pain, that I cannot bear to see a play presented in a theater. It seems to me nothing but lies. I cannot listen to one man speaking with another, especially before an audience. I must hear him alone, when he speaks with himself.

Someone has said he would like to have heard the conversation between Cain and Abel, and to have witnessed the scene that preceded Abel's murder. Not I. I should have turned away in horror and disgust. Cain's envy would have struck me just as false and insincere as Abel's innocence. I should like to have heard Cain alone, when he was not faced with his brother; or I should like to have heard him later, when he had been cursed by God, saying to God—that is, saying to himself, "My punishment is greater than I can bear: Behold, thou hast driven me out this day from the face of the earth; and from thy face shall I be hid; and I shall be a fugitive and a vagabond in the earth; and it shall come to pass that everyone that findeth me shall slay me." (*Genesis IV, 13-14.*) And for me to hear him say even this much, he would have had to be unaware of my presence—otherwise he would have lied to me. I should like to hear only the solitary cries of pain from the hearts of others . . .

In the same way that I have always scorned the theater, to the point of hardly ever setting foot in it, I have wished at times that I could enter a confessional to hear the unburdening of the sins and sorrows of a fellow-being. But I don't think I could stand that, either; because the confessional becomes a theater, and what goes on in it is nothing but histrionics. He who goes there to lighten his load of sin inevitably lies, whether he wants to or not and whether he knows it or not. He probably wants to tell the truth and believes he is telling the truth—when he does want to and when he does believe it—but he does not tell it. Either he forgives himself without being forgiven, or he blames himself when he is blameless. Either he fails to tell what he has done, or he confesses something he has not done. He will not confess simply and honestly his thoughts and actions; he is going to indict himself. And he who indicts himself lies just as certainly as he who exonerates himself.

This is why, annoyed with the theater and finding no con-

solation or delight in dramatics, I take refuge in lyric poetry. For here no one ever lies, although he may set out to do so.

Since I cannot hear the truth when one man speaks with another, nor when he speaks to me, I retreat to my solitude; there, alone, listening to my heart, I can hear all men speak the truth. I know your secrets because you told them to me when you were alone, when we could not see or hear each other. I heard them in the distant, muffled echo of those lying words you poured into my heart. Your lies were dissipated in the gross vibrations of the material air that carried them to my corporeal ear; only your naked truth remained when you left my presence.

The greatest of men is the poet—the lyric poet, that is: the true poet. The poet keeps no secrets in his heart from God; and when he sings of his grief, his fears, his hopes, and his memories, he strips and cleanses them of lies. His singing is your singing—and mine.

Have you ever heard more profound, intimate or enduring poetry than that of the Psalms? And the Psalms were meant to be sung when one is alone. I know they are chanted by crowds gathered under a single roof for religious services; but those who intone them are no longer members of a multitude. When one sings them, he withdraws into himself; the voices of the others resound in his ears only as an accompaniment and reinforcement of his own voice.

I notice this difference between a crowd gathered to recite the Psalms and one brought together to see a play or hear a speaker: the first is a true society, a company of living souls, wherein each exists and subsists separately; the second is a shapeless mass, and each member of it only a fragment of the human swarm.

I have never felt the urge to move a multitude and influence a great mass of people—who, by amassing, lose their personalities; on the other hand, I have always had a tre-

mendous desire to move the individual human heart and to influence each of my brothers in humanity. When I have spoken in public I have always tried to be lyrical in my oratory; I have tried to pretend that I was addressing a single member of my audience—any one of them, rather than all of them.

The great comforters of humanity, who give us the balm of their inexhaustible love, are the great recluses who retired to the desert to listen to the heart-rending lamentations of the pitiful human flock, lost without shepherd or dog in the desolate wastelands of existence.

During one of these frequent and violent strikes that occur these days, go up to that blessed mountain where you and I so often met in the presence of God, united in our solitude, and watch from there the movements of the infuriated crowd. Perhaps faint echoes of gunshots will reach your ears. From that vantage point, from where people seem like faceless and voiceless ants, you will come to understand best the spring that moves them and which they themselves are not aware of. If you were in their midst, you would suppose that they were moved by hunger, or hate, or envy, or the desire for liberty, or the thirst for justice; but from the top of our mountain you will see that they are impelled by the unique eternal anxiety.

No doubt you remember our comments that afternoon when from the mountain top we watched several couples dancing in the town square far below us; because of the adverse direction of the wind, the sound of the drum and flute to which they moved did not reach us. It is a common observation, and yet one that is always new, that to a deaf person, we who talk and gesticulate and listen carefully to each other must seem insane. It is the sound of the voice that creates the illusion of rationality. I suspect, on the other hand, that a blind man does not perceive how apparently mad we are.

From a distance, men seem to be what they really are:

creatures who dance and jump about in a meaningless way, stamping on the poor earth. We are amused at anyone who dances when no one is playing the flute; but how can we know what music he is listening to in the silence of his soul?

The real recluse dances in the center of the market place in the sight of all his brothers, to the sound of the music of the heavenly spheres which he alone, by virtue of the solitude in which he lives, can hear. The passers-by stop and watch him for a moment, shrug their shoulders, and go on their way dismissing him as crazy; or they form a ring around him and laugh; or they begin to accompany his dance, clapping their hands in glee.

Now I shall answer what you said not long ago in one of your letters. "You have begun to limp," you said. "You have begun to dance to the tune they play for you. You no longer belong to yourself; you belong to the crowd. Remember your advice of long ago: 'Never say: Of that water I shall never drink.'"

Well, you are wrong. I used to dance to the music that only I could hear. Some laughed at me; others called me mad or eccentric or a publicity seeker; some insulted me; some stoned me; and they went on their way. Of my audience there remained only a few who were amused by my leaps and pirouettes; and they began to dance themselves, shaking the numbness out of their legs. And this little circle of mine, thank God, has been widening; today I dance and leap at the center of a small crowd of people who clap for me. When they see me dance without music—for they do not hear the rhythms my feet are obeying—they keep the beat for me with their hands; and since their clapping is in time with my skips and capers, they believe that I dance to their tempo. This makes them clap more wildly; they cry, "Bravo! See how we make this man dancel!" They are unaware that I do not even hear their clapping, and that if I whirl faster when they applaud faster, it is because they clap to my dancing, rather

than because I dance to their clapping. And this is the advantage of dancing alone.

We men are impenetrable. Our minds, like our solid bodies, can communicate only by surface contact. They cannot interpenetrate, much less blend together.

You have heard me say a thousand times that most minds seem to be exoskeletal, like crustaceans; they carry the bone outside and the flesh inside. When I read in some book or other how painful and terrible it would be for a human soul to be imprisoned in the body of a crab, and to be forced to use the crab's senses and organs, I thought: "This happens in reality: we are all poor crabs, trapped within a hard shell."

The poet is one whose flesh has come out of his shell; his soul exudes. When our souls emerge in moments of grief or joy, we are all poets.

Now you can see why I believe it is necessary to agitate the masses of men, to winnow them, to stir them up, and to hurl them against each other; it is to see if in that way their shells can be cracked, so that their souls may spill out and mingle and solidify into the true collective spirit which is the soul of humanity.

Sadly enough, all past experience shows that these collisions, instead of fracturing our shells, simply harden them. Like calluses, they grow tougher and thicker with friction. Although perhaps the collisions have not been violent enough. In any case, impact, and not friction, is our only hope. I do not like to rub against people, but to strike them. Rather than approaching them obliquely and glancing off at a tangent, I want to meet them head-on and, if possible, split them down the middle. It is the best service you can do them. And there is no better preparation for this labor than solitude.

It is sad to reflect that we can communicate only by touch or, at most, by rubbing; and that all human contact must be

through the stony carapace that imprisons each of us. I believe that in solitude this carapace softens and becomes a tenuous membrane, capable of osmosis and exosmosis. This is why I say that it is solitude that makes men really sociable and human.

Some of us believe that man's goal is the creation of society—humanity itself; and that all our urges and strivings are aimed toward the day when the human race shall be a single organism, a kind of immense collective animal in which each man will be a cell—a spiritual madrepore. The end of man, then, would be humanity.

If this view is correct, then when that end has been reached society will recognize that recluses have contributed to its structure more than all the rest of mankind. Some anchorite or other in his desert will have done more than all the shepherds of men, who lead their flocks to victory or slaughter. One does not have to be immersed in humanity to lead it. You cannot know which of your fellow-beings will have the profoundest influence on your life, but you may be sure it will not be your closest companion.

I have said that for humanity to solidify and take shape, our shells must be broken or dissolved into thin membranes, and that their spiritual contents must escape through the cracks or ooze through the membrane and be mingled together. Then, when the notions of fools are melted down with those of wise men, and the purposes of scoundrels are fused with those of saints, I believe something grand and pure will result. Today we know only mixtures of ideas, and not compounds. If you remember your chemistry, you will recall the distinct difference between a mixture and a compound. In the realm of ideas and emotions a mixture is pernicious; a compound is not. Don Quixote and Sancho formed a mixture; but if they had been truly combined, what a portentous personality would have emerged! It would have been no longer man, but god.

But today we have to live in individual isolation, each within his shell which he cannot fracture—for these shells must be broken from without. We are not like baby chicks, who as soon as they feel the need for air crack open their prison; someone must free us from the outside. The plaintive cries that reach you in your cell are the moans of your brother; he, too, is imprisoned and cannot escape from himself. But if in pity you go to him and beat on his shell to break it and liberate him, he will know only that he is being savagely knocked about; he will groan more piteously and try to push you away. He has despaired of liberation. And if you are able to open a crack in his carapace, he will cry out even more when he feels the cold air blowing in. He will call you barbarous and cruel. Never mind; hammer away at him.

So perfect is the lamentable isolation in which we live, that now and then a man comes to believe he is alone in the world, surrounded by empty exoskeletons who, by some strange magic, move and speak as though they were filled with living spirit. Out of this profound sense of solitude emerges the intense melancholy of some recluses; and their insights are deeper because of it.

Since I am alone in the world—I say to myself in the moments when this fancy has taken hold of me—I must do all the things there would be no one else to do if I did not exist.

Don't you suppose—since I am in a confidential and confessional vein—that when they have accused me of not being a good Spaniard I have often said to myself: "I am the only Spaniard! I—not these other men who were born and live in Spain!"

Believing oneself to be alone in the world can wreak terrible havoc in the soul, even pushing it to the edge of lunacy. I remember a poor fellow who was considered half mad, and who did in fact end as a true monomaniac; he said to me once, "Don Miguel, you have no idea how I suffer from a piece of nonsense I've gotten into my head and can't get out

again. I realize it's a wild notion; I know how ridiculous it is, but I can do nothing about it. It has taken possession of me. Sometimes I feel it so strongly I don't dare leave the house." "What is it?" I asked, alarmed by this preamble. "Well," he answered, "there are times when I think I appear to other people as something entirely different from what I am; I have the impression that I'm not behaving as I think I'm behaving, but in some quite contrary fashion. Right now, for example, I think I'm telling you about my problem; but I have the impression that I'm really insulting you. When I believe I'm going down the street in a perfectly dignified manner, I wonder if I'm not making pirouettes and contortions and horrible grimaces; I wonder if the passers-by, although they seem to be paying no attention to me, are not really pointing at me and laughing."

I said to him, "Don't you think more or less the same thing happens to all of us? I know I have lost valued friendships because when I was saying one thing my friend was hearing something quite the contrary. When I notice a coolness toward me in some person to whom I am not aware of having done any harm, I think: It must be something I said unawares."

This experience must of necessity come to anyone who lives with his heart in his hand and speaks from his soul. It will always happen to him who has a membrane instead of a carapace. Because most people, when they discuss another, keep in mind that they are being listened to; so they lie. If they are speaking of a friend, they pass over his defects and exaggerate his virtues; if an enemy, they depreciate his excellences and dwell on his shortcomings. If you make an attempt to be truthful—if, speaking with affection and respect of a friend whom you love, you mention his faults—only the report of your vituperative slander will reach him.

This sort of thing is quite evident here in the city where I live, where I have encountered the thickest and horniest

carapaces I have ever seen. For a spiritual crustacean, there is no one to match the Castilian. You may be on intimate terms with him for years; but you will have no idea whether he has ever wept in his life, or why. They are all one piece. They understand everything in one piece. They are incapable of perceiving shades of meaning, or the concept of transition, or, least of all, the notion of the slightest understanding of their enemies. For them, what is not white is black. And what a genius they have for never getting anything right! And since they are gossips and tale-bearers and trouble-makers, one can never feel at ease with them. I can safely say that out of twenty accusations they may bring against me, eighteen are lies and the other two are exaggerations.

Since I am willing to confide in anyone, some of these Castilians charge me with treating everyone equally, making no distinction between those who are my friends and those who are not. No, to me all men are my brothers; I believe that any brother is worthy of my confidences. I do not feel I can be responsible for the use they make of my secrets. But the Castilians—the real crustaceans—confide in no one; I sometimes wonder if they have anything to confide. Their reserve is simply an internal emptiness. So, obviously, when they congregate it can be only to play cards or to malign their neighbors.

An environment of this kind creates a profound sense of solitude. I regret that my profession prevents me from surrounding and protecting this inner solitude with an outer one. I should like really to isolate myself, to retire to a desert—not for forty days but for forty months. There I would devote my days to the manufacture of a gigantic mace, bristling with iron spikes; I would harden it in the fire and try it against the boulders. When I had a weapon that satisfied me, I would return to the world with it in my hand and begin to shatter these poor crustaceans right and left, to see what they are like inside.

But here a question occurs to me: Are these shells broken from the outside or from the inside? I said earlier that they can be cracked only from the outside; that someone has to come along and break them for us. But I think I spoke rashly; it is not such a simple matter. It involves the gravest and most profound ethical and religious question: whether man must redeem himself or be redeemed; whether his duty is to break his own chains or to stumble in his shackles to free his neighbor.

If you think about it, the truth of the matter seems to lie in a combination of both points of view: the carapace must be splintered from the outside and from the inside at the same time. You go to liberate your brother because you hear him trying to escape; perhaps you hear his moans. The desire for freedom is the beginning of liberty. And when he feels you working to free him, he redoubles his efforts to free himself; and you redouble yours. You hear him scratching at the wall of his prison, and he hears you hammering on the other side. At the sound of your blows, he pounds harder; then you pound harder; then he pounds harder. Both of you—he from within, you from without—are working toward the same end. And most comforting of all, you pound on his shell with your own and he hammers on yours with his; so that both of you benefit. All redemption, then, is mutual.

This is what is meant by the power of example. I am not strong enough to pick up each of my fellow men, lift him over my head, and throw him to the opposite bank of the river; but I hope that if men see me throw one of them across, they may say, "He is only a man like ourselves; if he can do it, so can we."

The value of the great recluses is that they teach the rest of humanity the power of solitude and the fact that one can live very well alone. If another man can live in himself and by himself, so can you. The anchorite, far from despising his fellows, seems to exhort them: "Be men!" He who insults a

multitude is usually paying homage to each of its individual members.

For a long while I have been turning over in my mind the idea that the new age of the spirit (the first was the age of nature; the second, into which we have entered, is the age of reason) will open with the death of shame and the enthronement of what today is called cynicism. The supreme social institution of the age of the spirit will be public confession; there will be no secrets in the heart of man. No one will classify as evil the harboring of an illicit urge, or the lack of charity, or the bearing of ill will; the evil will lie in concealing such thoughts. And when that time comes and men's souls are naked, they will discover that they are much better than they believed they were. They will have pity for one another; each man will forgive himself, and as a consequence will forgive all other men.

If you extoll this splendid perspective of a glorious age, you may be sure that most of your listeners will be horrified. They will say that it would be a hell. They will tremble at the thought of their souls revealed in their nakedness. A society in which not only their souls but all souls would be stripped bare is beyond their conception. They will react with horror because they fail to consider how profoundly changed society would be. It is hard for us to imagine walking down the street with no clothes on; but if we were in a country where everyone had gone naked since the day he was born, we would blush to be seen fully dressed.

Since each of us believes that his soul has a hump on its back, or is covered with stains, we shudder at the idea of anyone seeing it; but if we all should uncover our souls, to find that humps and stains are generic, our fears would vanish.

"What about modesty?" someone asks. "What will become of that sweet and precious sentiment, the guardian of our most valued virtues?" Modesty will not disappear; it will be transformed into something higher and purer. Modesty will

consist in never concealing anything, in having no secrets. We shall blush for shame at having kept a thought to ourselves.

I know you will be able to convince hardly anyone of this. One of the saddest failings in most poor mortals is the lack of imagination; and those who profess it are the ones who have it least. They confuse imagination pitifully with the kind of memory that brings to our mind images from our common store. It is lack of imagination that makes it impossible for most people to conceive of a society with any other moral or economic basis than our own. For example, observe that when we consider what society would be like without the institution of private property—this observation has been made by others before me—some people discuss it as though they believed that every other institution would remain unchanged. They say, "If private property disappears, inheritance disappears; and if my children cannot inherit from me, why should I work?", along with other comparable pieces of reasoning. And thus it is in everything. It is as if a man, on being told that he was to be endowed with wings, should try to picture himself with wings as he is today, failing to perceive that he would no longer be the creature he is now, but something different.

Read all the sectarians and dogmatists, who insist that if some ethical or religious principle or other were removed from human consciousness, society would crumble. Read them, and you will see that what the poor devils lack is imagination. I heard one of them say the other day that a well-ordered society would be impossible if the fear of eternal damnation, of the devil, and of death should vanish from the mind of man. I felt a great pity for such poverty of imagination and human feeling. The poor little man could not grasp the idea that the rest of us could live a good life through motives that were quite different from those he believed he had. I say *believed*, because I am certain that he himself did

not refrain from doing evil for the reasons he supposed; he invented the reasons *a posteriori* in order to explain his conduct to himself. We feel a terrible necessity to rationalize our own activities, to account to ourselves for the good or evil we do.

Solitude can cure us of this, too; it can teach us to accept ourselves as we are and to forgive ourselves our own defects, without trying to find reasons. For the attempt to explain our actions to ourselves is a result of the everyday need to explain our conduct to other people. If we insist on finding a rationale for our virtues, it is because our neighbor holds suspect any goodness that is not like his, and because he cannot believe anyone can be good simply because he feels like it. It is this miserable social life, too—where we gather together to escape ourselves—that prompts us to find outside our own minds some working basis for our good actions, in a social and collective norm. Thus solitude teaches us to be truly virtuous; and only true solitude can teach this—the solitude we can maintain even in the uproar of the multitude, not drawing back within ourselves but spilling out into the crowd.

The supreme recluses are those who have let their spirits overflow; of all creatures they are the most sociable. It was Kierkegaard, one of the most solitary of thinkers, who asked, "Who has described the beautiful union of men more stirringly than he who remains alone?"

This is easy to understand, because the recluse carries an entire society within him; he who is solitary is legion. The strongest personality is that which contains the greatest generality, the largest number of other individuals. It has often been said that the genius is a multitude; he is the crowd personalized; he is a people turned into a person. He who has most of his own is the one who has most of everybody; it is he in whom all others are combined and reconciled.

There are two kinds of unions: one is effected by the sepa-

ration and removal of differences in the uniting elements, while the other is by means of fusion, composing these differences. If we were to subtract from each man's mind that which is peculiar to it, his way of looking at things, his special characteristics which he conceals for fear of being thought mad, and if we were left with only that which he has in common with all other men, the residue would be that miserable attribute called common sense: abstracted practical intelligence. But if we combined all the different personal criteria, all those individual notions which we guard so jealously, and mingled their caprices, oddities, and idiosyncrasies, what emerged would be human understanding—which is self-understanding.

The best ideas that occur to men come in solitude; they are the notions most of them dare not confess to themselves, let alone to their neighbors. These are the ideas from which they flee, and which they lock up within themselves while they are still pure thought, before they can flower into words. The recluse can dare to express these thoughts, and allow them to flower; and so he says aloud what most men only think. He thinks his ideas aloud, and startles the rest of us by saying what we are thinking under our breath. Men try to deceive one another by pretending to believe what they do not believe; but nobody is deceived.

What I have said here will help you to understand how solitude can be the highest school of sociability, and how it is sometimes best to withdraw from humanity in order to serve it.

The subject is inexhaustible. I shall say no more.

August, 1905.

SYMBOL AND OBJECT IN SCIENCE AND LITERATURE

William W. Main

I

MOST NON-SCIENTIFIC disciplines are on the defensive today; literature is one of these unquantitative, equation-less disciplines. It is not my purpose here to defend the underling and to attack the giant. There have been too many arrogant claims and too much throwing about of brains already by the sciences and the humanities. What is needed is clarification, not vigilantism. Each side must recognize the justice of the other's perspectives and the nature of the other's boundaries. It will serve no purpose, behavioral or introspective, to glare across at each other from a pink cloud to an iron cage. Such mutual distortions further alienate understanding in an already alienated world. Let us rather once again attempt to recognize and define two approaches to two dimensions of reality—that of science and that of literature.

Perhaps the simplest, most succinct statement of difference between the approach of science and the approach of literature to reality is that science sees reality as an object, and literature sees reality as a symbol. Whereas reality as *symbol* is transfinite, intuitive as well as cognitive, subjectively involved, experientially verifiable, and quantitatively incommensurable; reality as *object* is finite, purely cognitive, detached, experimentally verifiable, and quantitatively measurable. Scientific reality is objective; it is an object subject to human control. Literature, curiously enough, not only deals with numberless abortive and pessimistic attempts at human control of reality (pre-Renaissance and classical litera-

ture especially), but it also deals with man's attempts to resist being controlled (post-Renaissance and modern literature particularly). The suggested paradox here is that before man had learned how to control nature by science, literature reflected man's attempts to control his fate; after man had learned, with an amazing measure of success, to control his environment, literature reflected man's attempts to resist being controlled (as in Existential literature). Recall for example, Homer's Achilles, who fails to control his fate and to escape death. Again, recall James Joyce's Stephen Dedalus, who refuses to serve a controlling *status quo* of home, fatherland, and church. Between this ancient abortive attempt to control (by mutiny) and this modern resistance to control (by exile) lies the Renaissance figure of Shakespeare's Hamlet who is profoundly uncertain "Whether 'tis nobler in the mind to suffer/ The slings and arrows of outrageous fortune [in this case, to be controlled],/ Or to take arms against a sea of troubles,/ And by opposing end them [or not to be controlled]."

This puzzling question of Hamlet's cannot be answered by any of the behavioral sciences; in fact, it cannot even be approached by them, for the reality or unreality of human nobility, of suffering, of opposing adversity is not subject to scientific verification and experimental testing. Neither Hamlet's decisions nor his indecisions make his behavior predictable. This is by no means a charge against any clinical methodology; it is, however, a distinct limitation. Certainly, psychology, as long as it claims to be scientific, should not accept any answer which its own scientific procedures have not produced. This restriction seems to clarify the chief function of the behavioral sciences—to describe man's processes as accurately as possible. Hamlet's blood pressure and his brain waves could be accurately measured and charted during his soliloquy. But what do these objective data about Hamlet's naturalistic state reveal about Hamlet's question of

human existence—whether to be or not to be? And, indeed, here is the rub: any scientific approach to the nature of being must develop its answer *inside* being; however, the being of being itself is the deeper question that must be answered *outside* of being. In terms of a simple analogy, a word can be known from the inside by its component letters ("scientific knowledge"), but we must go outside the word to the alphabet if we ask the nature of the letters from which the word is made ("existential knowledge").

Hamlet asks both answerable and unanswerable questions. The question of the fact of Claudius' guilt is answerable and verifiable (by the behavioral observation of Claudius during the "mouse-trap" play; both Hamlet and his "clinical assistant," Horatio, record similar results). The question, however, of killing the guilty Claudius ("is't not perfect conscience,/ To quit him with this arm?") is answered neither by Hamlet nor by Horatio. Hamlet must accept or not accept the command given to him by the mysterious Ghost. Clearly, not all questions and answers are on the same level of human existence. Some answers (scientific: reason observing) are given by man; others (suprascientific: reason observed) must be given *to* man. Hence Hamlet's "There's a divinity that shapes our ends/ Rough-hew them how we will." As Paul Tillich emphasizes throughout his illuminating studies, man must ask questions about himself and his being, but he cannot give an answer back; he must receive an answer back. Hamlet's relationship to his rational, stoic school friend Horatio is essentially scientific or objective: human reason and observation can give the answer to Claudius' guilt. Hamlet's relationship to the Ghost, "my father's spirit," is essentially suprascientific or symbolic: only a power beyond the very bourn of life and death can give the answer to Claudius' life and death. Hamlet asks Horatio to observe Claudius, but the Ghost commands Hamlet to revenge Claudius. The source of man's answers becomes the boundary line between

science and literature, between "technical knowledge" and "existential knowledge" (Tillich's terms), object and symbol.

II

Literature and science, therefore, provide two different dimensions of knowledge—symbolic and objective. Thus far we have distinguished each dimension by the nature of the question each asks. Objective science asks questions that can be developed out of man's existence, that can be answered by man speaking to man (Horatio to Hamlet). For example, a reliable, as well as fearless, witness to a murder can identify the murderer. However, if there were a clueless crime of murder without a witness, are we to deny the fact that there exists a murderer? (This untenable attitude, in effect, is characteristic of the hard-headed, positivistic scientist who is resolved never to speak about things he cannot know as observables, principally observable properties. All things which cannot be observed are good only for philosophical speculation or idle thinking, he believes.) Clearly then, symbolic literature asks questions that cannot be entirely developed out of man's existence, simply because the questions are *about* man's existence: "To be, or not to be: that is the question." When man asks the question of his own being and existence, the answer must come from *beyond* existence, else the answer *repeats* the question. Similarly, we use a variety of clocks and meters to time certain processes, reactions, and all kinds of behaviors; yet none of our timing devices can answer the question of what time is. To answer this question of time and timing, Hamlet looks above time ("There's a special providence in the fall of a sparrow"), and then he looks back into time ("the readiness is all"). The answers to time, to being and existence, to the unwitnessed murderer must all be answered by man listening to symbolic reality, not merely by man observing objective reality.

In order to elaborate the concept of symbolic reality, I should like to compare the two structures of knowledge as found in science and literature. These two structures may be called the subject-object structure of knowledge and the subject-symbolic structure of knowledge. In the subject-object structure A is B , or A is not C . Water is a liquid; water is not a gas. Several properties of water may be expressed in this equation relationship, such as the chemical composition of water (H_2O), its density, its freezing point, its boiling point, and so forth. All of these objective properties may be expressed by an equal sign ($=$) or by a form of the verb *to be* (*is, are*). The subject-object structure identifies one class, such as the subject water, with another class (or classes), such as an object liquid. The subject-object relationship is a logical relationship based on the laws of inclusion and exclusion. Either concrete properties (blond, brunette) or functional relationships themselves (brother, sister) may serve as the including or excluding shibboleth for an equation.¹

If the subject-object structure basically *equates*, the subject-symbolic structure primarily *points*. The symbol must point because it is and it is not what it is. This paradoxical statement may be illustrated by giving to water a traditional symbolic value of purity or purification. Ordinary water, which consists of hydrogen (11.188 per cent by weight) and oxygen (88.812 per cent), is considered pure. We can equate purity and water because water does *partake* in the quality of purity. However, ordinary water, even triple distilled water, contains impurities; in the *absolute* sense it is really not pure, that is, water is never equal to infinite purity. Hence water as a symbol of purity must negate itself—water must somehow not be water—if it is to transparently symbol-

¹ For a fuller discussion of this particular problem of relationships, see Ernst Cassirer's *Substance and Function and Einstein's Theory of Relativity*, reissued 1953, New York: Dover Publications. In his first chapter Cassirer makes his fundamental distinction between *thing-concepts* and *relation-concepts* (p. 9).

ize ultimate purity. The final test of a symbol is that it negates itself, so that it can become transparent and reveal that which it symbolizes.² Water, of course, may have many other pointing or symbolic values besides purity. It could point to death and dying because of death through drowning. Again, it could point to birth and life because of the origin of life in the "watery" womb. By combining both of these symbolic values, water could point to death and rebirth, or resurrection. (The ritualistic sacrament of baptism suggests a whole cluster of symbolic values.)

It must be emphasized that though the symbol partakes in what it points to, it is not that which it points to. Since the symbol is a concrete-universal, it is and is not the thing it symbolizes. When it allegedly becomes the thing it symbolizes, the symbol is distorted into an idol, which is a finite elevated to the infinite. The distortion of symbols, either by elevation into idols ("water really is absolute purity"), or by reduction into objects ("water is merely H_2O "), is profoundly dramatized in such a work as *Moby Dick*, where the symbolic white whale is both idolized and objectified. The symbol, moreover, is neither merely a sign nor a metaphor. A sign is expedient and conventional; for example, the shapes of traffic signs or the operational signs in mathematics. Pavlov's dogs could have as easily been conditioned to salivate at the sign of a booming drum as at the ringing of a bell. Signs are arbitrary; symbols are not. As for metaphor, it discovers an identity between objects (e.g., the world is an oyster), objects frequently unlike. This imaginative comparison between objects has no strict symbolic value since the objects point to each other and not beyond each other. The metaphorical relation is essentially finite; the symbolic relation is to the infinite.

² For a penetrating analysis of the symbol, see Paul Tillich's recent book in the World Perspective Series, *Dynamics of Faith* (New York: Harper, 1957). Chapter III, to which I am indebted, discusses the meaning of symbols and myths.

III

A direct answer should be given to the question, Why are symbols necessary? Why are not objects enough? Certainly objects would be sufficient if all knowledge were restricted to finite relationships and observable properties. Were crime and punishment but detective work and legalism, there would be no need for Hamlet's delay nor for the Ghost's presence. However, neither induction, deduction, nor the code of Hammurabi is adequate for Hamlet's revenge; this simple code of an eye for an eye satisfies Laertes' revenge, but only after Laertes renounces conscience and grace. Laertes must simplify his case in order to justify it. Hamlet, with no certitude, approaches his revenge symbolically; Laertes, with complete certitude, approaches his revenge objectively. (The one time Hamlet does succumb to rash certainty, he kills the wrong man, Polonius.) The problem of certitude, we must surmise, is directly related to the problem of symbolic knowledge and objective knowledge.

We may restate the question of knowledge riddle-wise: when does an object cease to be an object? Answer: when it becomes more than an object. And it is more than an object when it is incomplete. The broken circle points to the completed circle, and the completed circle still points to the squared circle. *Pi* (π), like Keats's "bold lover" ("Bold lover, never, never canst thou kiss,/ Though winning near the goal—") in the *Ode on a Grecian Urn*, will never reach the last decimal of consummation (3.14159265. . .). Metaphorically speaking, *pi* is symbolic; it expresses an incompleteness and points to a completeness. Likewise, incompleteness is symbolic, and completed actuality is non-symbolic, or objective. Still metaphorically, a fraction (nine-tenths) is a symbol until it reaches (ten-tenths); then it solidifies into an object. As long as potentiality is not fully actualized, life remains, so to speak, symbolic.

Potentially (and being) in opposition to actuality (and becoming) creates an inexhaustible tension between the unknown and the known. Here is where all kinds of dangers, illusions, oversimplifications, and false certainties may arise. What is the true relation between the known (the measurable) and the unknown (the immeasurable)? Can we ignore the unknown and deal exclusively with the known realm of observable actuality? Such is the position of the hard-headed scientist and of Laertes. Can we, through patient cognitive analysis, gradually unveil the unknown, so that what was indeterminate is now determinate (i.e., can we supposedly naturalize symbols into objects)? Such is the position of the sanguine scientist and of Horatio and Hamlet when they verify Claudius' guilt in the "Mouse-trap" play. In the first case the unknown was excluded; in the second, it was reduced. However, neither exclusion nor reduction really answers the main question, because the unknown is a permanent power that can neither be banished nor unbuttoned; nevertheless, it is still dynamic within the realm of the known. Hence the Ghost of Hamlet's father, a symbol of the unknown, directs Hamlet's "prophetic soul" despite Hamlet's perplexed brain, puzzled will, and fearful conscience.

To grasp the full significance of the symbolic unknown, we must remember that it was the Ghost that revealed the murder—his own, of course. In other words, reality is so complex that it takes the unknown to reveal the known! Besides the known patiently uncovering the unknown (objective knowledge), Shakespeare further shows us the infinite unknown revealing the finite unknown to the unknowing (symbolic knowledge). It is an "unknowing world" that the unknown must reveal itself to. The startling paradox of this ultimate form of symbolic knowledge is that the unknown reveals itself and still remains a mystery. ("No traveller returns," but the Ghost did—and more than once.) The mys-

tery of the Ghost remains even after it has revealed the murderer. Here we *possess* knowledge and *are possessed* by unpossessed knowledge (mystery) at the same time, and this is the unsimplified relation between the known and the unknown. Instead of exclusion or reduction, we have symbolization—the tension of incomplete completion, a tension that may also be expressed as a concrete-universal or a finite-infinite.³

To summarize, symbols are necessary because true and complete knowledge is incomplete, ultimately potential. And the truth of symbolic knowledge is that the potential discovers the actual, the unknown reveals the known. Man partakes in both the known and the unknown, for he needs the unknown to know. The actual and the known cannot seriously exclude nor diminish the potential and the unknown; on the contrary, they must depend on the powers of the potential and the unknown to actualize and know themselves. It is one thing to know the latitude and longitude of a ship by celestial calculations; it is quite another to know the pointing star that gave the bearings to begin with. The power of the unknown star guides the ship, not vice versa; the knowledge that controls the ship is controlled by the uncontrollable stars. Here science (calculation) and literature ("star knowledge") meet but do not conflict. In Shakespeare's familiar lines, "It [love] is the star to every wand'ring bark,/ Whose worth's unknown, although his height be taken."

Modern science has discovered that the line of demarcation between a taken height, or objective calculation, and an unknown worth has become uncomfortably blurred. I am referring to the quantum theory and its principle of indeterminacy or uncertainty. The relevant point for our discussion, as explained by George Gamow in *One, Two, Three . . . Infinity* (1949), is the discovery in quantum physics that

³ See Philip Wheelwright's refreshing analysis of "Man's Threshold Existence" in *The Burning Fountain*, (Bloomington: Indiana University Press, 1954), a volume indispensable for the understanding of symbolism.

"there is a certain lower limit for any possible interaction between two different material bodies" (p. 143). This irreducible interaction found in microphysics resulted in the principle of uncertainty, originally expressed by Werner Heisenberg in 1927. "According to this principle, it is impossible to specify precisely and simultaneously the values of both members of particular pairs of physical variables that describe the behavior of an atomic system" (Leonard I. Schiff, *Quantum Mechanics*, 1948, p. 7). The central relations in this disturbing principle are, in Gamow's words again, "the better one defines the position [of an electron's trajectory], the more indefinite the momentum becomes, and vice versa" (Gamow, *Mr. Tompkins in Wonderland*, 1953, p. 87). In observing the motion of atomic structures, it seems, the observer interferes with the object of his observation, so that the act of observation itself becomes integral with the motion observed. The very act of knowing transforms what is known.⁴ It thus appears that on the microlevel of phenomena, reality, so to speak, becomes personal and refuses to be objectified; no longer can science sufficiently detach itself to measure position and velocity together. Either of the two may be objectively known, but not both. What emerges here from the present state of knowledge of quantum mechanics is a truth that literature has always known: If man wants reality, he must sacrifice certitude; and if he wants certitude, he must sacrifice reality.

IV

The constitutional difference between science and literature—object and symbol—has been differentiated on the basis of whether one develops his answers out of existence or whether one asks about the question of existence itself. Any concrete piece of reality may become a symbol (even "sacra-

⁴ Cf. Niels Bohr's "complementarity principle" (1928), which describes "the relation of experiment to theory" (Max Born, *The Restless Universe*, 1951, p. 162). Chapter III of Born's uniquely illustrated book explains the physical origin of uncertainty in the duality of "waves and particles," as displayed particularly in the nature of light.

mental," if the transcendent is perceived to be present), depending on how profoundly one cares to question it. Man can always *raise the question* of ultimate reality, and when he does this, he separates himself from objective reality. Science and literature clearly make different demands on reality. When man does demand from concrete reality more than objective measurements can yield, he forces concrete reality to point beyond itself. More accurately, he forces concrete reality to lie about itself in order to tell the truth about itself. This paradox lies behind Touchstone's familiar judgment that "the truest poetry is the most feigning." To cite an optical illustration of deception for the sake of truth, I invite your attention to the architectural distortion used in Greek temples (the columns are bent slightly inward) to give the true appearance of upright columns. Or again, the technique of perspective drawing in art is but a two-dimensional deception to give the appearance of a three-dimensional truth. Literal deception is always necessary to render symbolic truth, because one is compelled to use the finite to express the infinite, the actual to express the potential, the complete to express the incomplete, the possessed to express the unpossessed, the known to express the unknown. A symbolic expression of "truthful lying" would be the image of blindness as illustrated in such figures as Teiresias, Oedipus, or Gloucester. In the latter figure from *King Lear*, for example, Gloucester has his eyes cruelly gouged out. He is literally blind. Yet the concrete fact of Gloucester's blindness does not tell the ultimate truth about Gloucester's blindness, for in his optical blindness Gloucester for the first time "sees" the truth about his loyal son Edgar and his treacherous son Edmund. ("O my follies! then Edgar was abus'd . . . I stumbled when I saw.") The literal and symbolic truths about Gloucester's blindness are darkness and light. The concrete reality of blindness must lie about itself (by expressing sight) in order to tell the truth about itself (that darkness brings

light). The opaque fact of blindness negates and transcends itself into a transparent symbol of new vision. The symbolic in relation to Gloucester's blindness is not less true than the objective literal, but this true-false blindness is the only true way of expressing the ultimate reality of Gloucester's blindness.

Not only must symbols falsify literal reality in order to express ultimate reality, but if the symbolic expression itself is lost, the ultimate reality is lost. Michelangelo would have lost the true proportions of his figure of Jonah, for example, had he not foreshortened reality. Reality must be foreshortened to *express* its truth. Again, had Shakespeare treated Gloucester's blindness as mere physical blindness without "foreshortening" it into a new vision, we would have lost the ultimate reality of light out of darkness. When such truth is reduced to the realm of the observable, particularly to calculable finite relations, it is badly distorted and frequently lost. Radically stated, without falsification truth is false. Moreover, if a symbolic expression is replaced by abstraction or philosophical statement or pure doctrine, its truth withers, like an uprooted tree. The concrete symbol keeps the symbolic truth alive. Gloucester's discovery of the truth cannot be abstracted from Gloucester's blind eyes. Without the blind fact, there could be no transparent truth. Symbolic truth must remain telluric, earth-born. Attempts to desymbolize symbols or demythologize myths result in ideology and independent theorizing. "Myth is always concrete and expresses life better than abstract thought can do," Nicolas Berdyaev emphasizes in *Freedom and the Spirit*, (1935, p. 70). "Myth presents to us the supernatural in the natural—it brings two worlds together symbolically." Symbols, like myths, must be conceptualized for critical and cognitive analysis, but they must not be desymbolized, demythologized. Perhaps the central task, sovereign above all others, in the study of literature is to conceptualize symbolic expression, that is, to make conscious the symbolic character of literature

despite the resistance of historical literalism on the one hand and abstract formalism and formula on the other.

It should be obvious that symbolic truth cannot be verified by repeatable experiment in a laboratory. (Gloucester has only one pair of eyes, and he is not a machine.) Yet nonexperimental verification, though less exact and definite than experimental verification, does occur within the living process of life itself. This I would call experiential verification. Again, Gloucester verifies his follies through experience, not experiment; and all experience involves risk, which may turn out to be a good or bad risk. Gloucester took a foolish risk on his bastard son Edmund and lost; yet he won the truth through his loss. The life process itself makes the test, not the controlled laboratory; and indeed, nothing in the life process can be determined a priori.

As a prolegomenon, this analysis has distinguished symbol and object by their constitution (the finite-infinite relationships), their structure (equate *versus* point), and their expressive form (the false-true ambiguity). Literature and science need not, and should not, conflict if each remains in its own valid dimension. The problem, for example, of whether light is particle-like or wave-like (or both) is an objective problem, not a symbolic problem. At the same time, the problem of how "light thickens" in *Macbeth* is a symbolic problem, not an objective problem. Again, in the *Divine Comedy*, Virgil (who may be allegorized as reason) serves as Dante's guide in hell but not in paradise; nor does Beatrice (who may be allegorized as revelation) descend from paradise to lead Dante through hell. Each keeps within his own sphere or dimension. As the stoic Horatio in *Hamlet* so wryly observes, ghosts do not come from the grave to tell us that villains are arrant knaves; a dictionary and simple logic are sufficient. Where subject and object meet in a cognitive relationship, science is in command, and where vision and meaning meet in an artistic symbol, literature is sovereign.

THE NATURE OF PROBABILITY

*Sir Ronald Fisher*¹

IT IS NO SECRET—it is a fact that I have stressed particularly in a recent book of mine on scientific inference²—that grave differences of opinion touching upon the nature of probability are at present current among mathematicians. I should emphasize that mathematicians are expert and exceedingly skilled people at the particular jobs that they have had experience of—in particular: exact, precise deductive reasoning. In that field of deductive logic, at least when carried out with mathematical symbols, they are of course experts. But it would be a mistake to think that mathematicians as such are particularly good at the inductive logical processes which are needed in improving our knowledge of the natural world, in reasoning from observational facts to the inferences which those facts warrant. Now when we are presented, as we are at the present time in the 20th century and perhaps especially in this country, with grave differences of opinion of this sort among entirely competent mathematicians, we may reasonably suspect that the difficulty does not lie in the mathematics—or at least only incidentally or accidentally in the mathematics—but has a much deeper root in the semantics or an understanding of the meanings of the terms which are used.

It's not the first time that grave differences of opinion among mathematicians have occurred on this very question of probability. Looking over the history of the subject, I

¹ This paper represents the substance of an address given in November 1957 at Michigan State University.

² *Statistical Methods and Scientific Inference* (Edinburgh: Oliver and Boyd, 1956).

think we can say that a crucial set of circumstances occurred at an early period, in the 17th and 18th centuries, at the time when the interest of mathematicians in the area of probability hung upon the high social prestige of the recreation of gambling, and mathematicians were constantly being approached by persons of the highest social standing, worthy of every respect and service, in order to solve the knotty problems that arose in this recreation; and this activity was manifestly the mainspring of the interest of the galaxy of distinguished mathematicians who, at that period, gave their attention to the subject.

May I just mention a few names illustrative of that period: Pascal, Fermat, Leibnitz, Montmort (all of whom functioned principally in France), De Moivre and Bayes (in England), and Bernoulli (who didn't live quite in France because he was a member of a distinguished family of the town of Basel). And I am inclined to say that all of those founders of the mathematical theory of probability understood the meaning of the word in one way, and they had the great advantage of coming to an understanding of the word which they used in their work, in that they were brought frequently into contact with its practical applications in the real world.

Now one of the difficulties in the teaching of mathematics in the present century is the difficulty of representing in mathematical departments those arts, crafts, skills, and technologies to which statistics is now being actively applied. It would seem an almost impossible task to staff a mathematical department, to get even a representation of the immense variety of practical affairs in which mathematics or statistics is applicable and is now being used. That is a problem for the organizers of education.

My own problem is a much narrower one. I want to make clear what I mean by probability; I want to make clear, so far as I can, why it is that quite a number of mathematicians fall into what I consider to be manifest fallacies in this field.

My business, you see, is one in semantics, the meaning of the word; and the meaning of the word only comes into existence by usage, and so I define the usage that I am concerned with as that of these 17th and 18th century mathematicians. If we wish to speak about something else from that which they call probability, then I think we should find a different word; but I doubt if there is anything else of so great importance that we should consider. We can trace, I think, some of the difficulties of such a word to the mathematical mind. Clearly, the purpose of the notion of probability is to express—and express accurately, with mathematical precision—a state of uncertainty; and states of uncertainty are not familiar in the processes of exact deductive reasoning.

Probability is, I suggest, the first example of a well specified state of logical uncertainty. Let me put down a short list of three requirements, as I think them to be, for a correct statement of probability, which I shall then hope to illustrate with particular examples. I shall use quite abstract terms in listing them.

- (a) There is a measurable reference set (a well-defined set, perhaps of propositions, perhaps of events).
- (b) The subject (that is, the subject of a statement of probability) belongs to the set.
- (c) No relevant sub-set can be recognized.

I expect that these words will acquire a meaning from the examples I have to give.

Let us consider any uncertain event. A child is going to be born. I don't know enough about the present state of medical science to know whether experts exist who are really capable of saying in advance of what sex the child will be. But let us imagine ourselves in the technology of the 19th century, when certainly no such statement could be made with any confidence. This is my first example of a matter in which we

are in the state of uncertainty; that is to say, we lack precise knowledge, but we do not lack all knowledge. On inquiry at the registrar, we may find that in his experience, or in the experience of much larger numbers recorded by registrars in different parts of the world, a fixed proportion of the births has been of boys and the remainder of girls. Let us suppose he tells us that in 51 per cent the births are those of boys (a little more than 51 per cent in most populations). To the registrar, the birth which is about to take place, though intensely important to ourselves, is just another birth. To him it belongs to this set of his experience of sex at birth, and he very properly informs us that the probability of a boy is 51 per cent, having made reference to this measurable reference set as the basis of his statement.

Secondly, we satisfy ourselves as to the existence of relevant sub-sets. I need not use the word "random" because all I need say can be said under "(c)," which is the most novel in its formulation if not in its idea, the most novel of the requirements I have listed. This is a formulation which I submit to your judgment as a competent formulation of what is needed if we are to speak without equivocation of a probability of something in the real world.

The registrar might raise such a question as this: Is it a white birth or a colored birth? In his experience, the sex ratio might be different. Very well, then, it's a white birth. We have recognized a sub-set of white births, and he must turn to his tables and find out what the proportion is in respect to white births, ignoring those which do not belong to the particular sub-set to which our event belongs. Or again, his experience might have shown that first births have a higher sex ratio than births in general. He will then inquire whether our birth is a first birth or not. If it is a first birth, it belongs to a relevant sub-set. It is now recognized and takes the place of the reference set with which we started.

Exactly the same considerations may be applied to any

other case of uncertainty. Let us take the case of deliberately arranged uncertainty, which occurs in games of chance.

I mentioned the importance of the recreation of gambling as calling attention of mathematics to this new concept of probability in the 17th century. The concept was unknown to the Greek mathematicians; it was also unknown to the Islamic mathematicians, perhaps because gambling was forbidden by the Prophet. But it was not only the taste for gambling, I think, which made the difference; it was the fact that by the 17th century the technology of the manufacture of the apparatus of games of chance had reached a point at which the calculations of mathematicians have some relevance. They were not playing with knuckle-bones; they were playing with very well made dice.

Consider the gambler who has laid a stake on the assertion that an ace will be thrown. It's worth a lot of money to him. He doesn't want to mistake your meaning if you say, as perhaps De Moivre might have said, the probability of an ace is one-sixth. In saying that, he is saying that this is just one throw out of all the possible throws that might be made, and he will regard these possible throws as a reference set, measurable, of which the fraction exactly one-sixth are aces. His reasons for doing that don't immediately concern us. It is a common sense reason, perhaps, that the die has been supplied by a reputable maker, that it has six faces, that the aim of the maker has been to make it approximately a perfect cube, and to make sure that the center of gravity is equally distant from each of those faces.

Contrast that, however, with a much more sophisticated and typically useless definition of probability, which is sometimes fed to mathematical students. It goes something like this:

$$Pr\left\{\left|\frac{a}{n} - \frac{1}{6}\right| > \epsilon\right\} \rightarrow 0$$

If a aces occur in n trials, then the difference in absolute value between the fraction $\frac{a}{n}$ and $\frac{1}{6}$ will have a probability of exceeding any positive number ϵ , however small, a probability which will tend to zero as n tends to infinity.

You see, that is someway away from the real world already. The gambler deserves something better than that. He may ask you, "What do you mean, 'tends to infinity'?" "Well, you go on rolling, and you don't stop—you go on rolling; you go on rolling until the die is worn to a sphere; you go on rolling until the sun goes out; but still you haven't reached infinity and are still a long way off." And then, it's not only that; as a practical man he doesn't like that, of course. "But," he says, "I asked you what you meant by probability, and here you are, you've brought in the same notion of probability in your definition. How do I know what *that* probability means?" We have a perpetual regression defining probabilities in terms of probabilities in terms of probabilities; that is a purely logical objection to the definition. But the real objection, if I may say so, for the practical gambler who wants to know about his stake, is that it says nothing about the particular throw in which he is interested. It says something about what we should ultimately regard as the reference set, certainly; but it says nothing whatever about his particular throw. And of course it might occur to him that though this was true of throws in general, yet in particular groups of throws within that general set, in particular sub-sets, the fraction might be different, perfectly consistently with this general statement.

Consider a few possible sub-sets. Here's a recognizable sub-set: throws made on Friday. He can recognize that sub-set of possible future throws, and he knows his throw is one of them. But so far as we know, shall we say, according to the axioms on which the mathematicians were advising the gambler, throws made on Friday do not give a different frequency

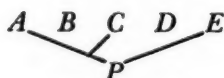
of aces from throws made on other days. So it is recognizable, but not relevant. It doesn't alter the estimate. And then, perhaps you say, odd numbers: 1, 3, or 5. A very relevant sub-set, if it could be recognized. But the makers of dice and other apparatus of gambling have taken care—they have taken a great deal of trouble to make sure, in fact—that such a sub-set cannot be recognized before the dice are thrown. And, thirdly, let us suppose that our gambler has heard of Professor Rhine of Duke University, and that in the opinion of Professor Rhine, some of his students have the remarkable gift of precognition. The gambler perhaps makes an agreement with such a student to sit by his side while he is rolling the dice and give him a nudge when an ace is coming. Here you have, let us say, two possible cases. Perhaps the prophet is some good—and what that means is that the sub-set of throws in which he gives the signal to his patron has a proportion of aces which is greater than one-sixth—it is possible it might be a third if he is a pretty good prophet. And in that case I submit that the gambler has a recognizable and a relevant sub-set, and that to him, on his knowledge, on his information, on his data as we sometimes say, the probability is not one-sixth, but a third. On the other hand, if, after some experience he comes to the conclusion that his prophet is no good at all, he will not lose his knowledge of the probability—it will merely revert to its value of one-sixth. He will now be in the position of saying that there is a measurable set with a frequency of one-sixth, and there is no relevant and recognizable sub-set which I should prefer to it.

Now that, I hope, sounds easy, and I want to get a little closer to the psychological difficulties which cause difference in understanding as to the meanings of these words.

The first difficulty is that we are making a statement of uncertainty, and that statements of uncertainty are not familiar in the ordinary course of deductive mathematical argument. They introduce special logical requirements. You notice, my

third condition was that no sub-set should be recognizable. It is a postulate of ignorance. How are we to take account of postulates of ignorance, as we have to do in inductive reasoning? In the ordinary course of deductive reasoning, the reasoner is supplied with what I shall call, for the moment, "axioms"—the term doesn't matter very much—and if he can prove what he wants to prove by using axiom *A*, axiom *C*, and axiom *E* to give the proposition, he is perfectly entitled to do so because he is arguing with certainty, and the truth of axioms *A*, *C*, and *E* are not at all precluded or interfered with by his axioms *B* and *D* that have not entered into his argument.

Axioms



But suppose he were making a statement of uncertainty. Then *B* and *D* do matter. In inductive reasoning the whole of the data, or the available axioms, or the available observations, has to be taken into account, and it is only because of that particularity of inductive reasoning that axioms of ignorance matter. There the postulate of ignorance asserts that certain things are not known and that the validity of the argument requires that they should not be known; and of course this is fundamental to any correct statement of uncertainty. If all sorts of other additional information could be sprung on you at any stage in the argument, you might discover there was no uncertainty at all, or, more easily, that the degree and nature of uncertainty which you have arrived at is totally different from what should have been arrived at if everything had been taken into account.

Now, at the end of the last century, a group of rather distinguished mathematicians, Hilbert, for example, and Peano,

set out on a project which was to show that the whole of mathematics could be deduced with strict irrefragable logic from certain chosen axioms. Peano had a shot at setting up such axioms that would suffice for the deduction of the whole of mathematics. That project was influential—it still is influential, I think, in spite of the setbacks that it has received. It was influential, for example, in producing Whitehead and Russell's *Principia Mathematica*. It was quite fundamental to Keynes' book on probability.

But difficulties have arisen. It was fairly easily demonstrated, and it came as a surprise to a good many people, that if a system of axioms allowed of the deduction of any contradiction (any fallacy, if you like)—if it allowed the proposition P and also the proposition *not-P* to be deduced by the ordinary rigorous processes from the same system of axioms—then that system of axioms contained latent *all* contradictions, in the simple sense that any proposition whatever could be deduced from them.

There is a story that emanates from the high table at Trinity that is instructive in this regard. G. H. Hardy, the pure mathematician—to whom I owe all that I know of pure mathematics—remarked on this remarkable fact, and someone took him up from across the table and said, "Do you mean, Hardy, if I said that two and two make five that you could prove any other proposition you like?" Hardy said, "Yes, I think so." "Well, then, prove that McTaggart is the Pope." "Well," said Hardy, "if two and two make five, then five is equal to four. If you subtract three, you will find that two is equal to one. McTaggart and the Pope are two; therefore, McTaggart and the Pope are one." I gather it came rather quickly.

That wasn't, however, the worst that befell the theory of the axiomatic basis for mathematics. It pinpointed the need for some means of demonstrating that a system of axioms *was* free from all contradictions, because if it wasn't it could lead

to anything. And then the blow fell, which was due, I believe, to Gödel, who put forward a very long, very elaborate, and extraordinarily ingenious proof to the effect that you could not, basing your reasoning upon a given system of axioms, disprove the possibility that that system could lead to a contradiction. Now that was a surprise to people, but I don't think it ought to have been. After all, suppose a Ph.D. student came, breathless with excitement, and said, "I have *proved* that this system of axioms is free from all contradictions." You'd say, "Did you prove it using only those axioms?" He might say, "Yes, I have written out a chain of propositions which demonstrate that these axioms are free from contradiction." Well, I suppose you'd look at him with mild surprise, and you might say, "I suppose you know that if this system of axioms *did* contain a contradiction, you could prove exactly those same propositions." And so you have the situation that certain propositions which purport to prove the truth, the truth of the theorem, could be equally well demonstrated by the ordinary rigorous processes of deductive reasoning if they were false. And I don't know how much we would give, then, for the chain of theorems which purported to prove that the system of axioms was free from contradictions. It would seem to be a little absurd to imagine that such a thing was possible.

Now, if I were to illustrate the mathematics, it would not appeal to a large proportion of the audience. But I want to give a few comparatively slight illustrations of how the controversies that I have alluded to affect our practical mathematical reasoning. Some of us think that if one had a sample which was known to be drawn from a normal population—a sample of N observations, X_1, \dots, X_N —that by taking the mean of that sample (that is, by adding up the individual observations and dividing by their number), and by taking the mean square deviation, using the sum of $(X - \bar{X})^2$, treating it appropriately, as Gauss suggested, and getting what is called the

sample variance of the mean, $s^2 = S/N(N-1)$ —some of us believe that one can then make probability statements of the kind that the true mean (μ) of the population is less than a calculable limit with an exactly known probability. In fact, the statement can be made that the probability that the unknown mean of the population is less than a particular limit, is exactly P . Namely $Pr(\mu < \bar{x} + ts) = P$ for all values of P , where t is known (and has been tabulated as a function of P and N).

This is exactly the sort of specification of our uncertain knowledge of the constants of nature that scientists have for a hundred years thought they possessed about them. The conditions required are more stringent than has been generally realized, but these conditions can be met in a number of useful cases, and in these cases the quantity under discussion, although of course not known with exactitude, is accurately specified as a random variable about which exact probability statements can be made for all possible values of the probability.

This is a single example of a large number of such inductive inferences that are made by the same process of reasoning. They have been disputed, I think principally on this ground, that it is not clear to all mathematicians that a probability statement is based on data, and that it is no defect in such a probability statement that it would be different if the data were different.

Let me examine this simple example. We have a limit which we can calculate, and it is undoubtedly true that this limit exceeds μ with given probability in the reference set defined by any value of μ . If a population with a mean μ were sampled repeatedly, we would certainly get this quantity exceeding μ with a given probability. That, I believe, is not disputed. It is also true that if we take the statement in general we have proved it for all μ , and therefore for the reference set for all samples from all populations. Each

sample has peculiar values (μ, \bar{x}, s) , and for this enlarged reference set it is true that $Pr(\mu < \bar{x} + st) = P$, where t is "Students" deviate corresponding with the (one-sided) probability P .

That, however, does not settle the matter. There are two conditions which should be satisfied in addition. I would like to emphasize these because you will find examples in the literature where this sort of inference is drawn without any reference to the conditions, and usually drawn with reference to what is really irrelevant, namely, certain beliefs about tests of significance—"the theory of testing hypotheses," or perhaps the theory of decision functions. The two requirements that *are* necessary flow from the third condition which I laid down for a correct statement of probability, namely, that no relevant sub-set should be recognizable.

Now suppose there were knowledge a priori of the distribution of μ . Then the method of Bayes would give a probability statement, probably a different one. This would supersede the fiducial value, for a very simple reason. If there were knowledge a priori, the fiducial method of reasoning would be clearly erroneous because it would have ignored some of the data. I need give no stronger reason than that. Therefore, the first condition is that there shall be no knowledge a priori. And the second condition is that in calculating the limit, the second term of the inequality concerned, we should have used exhaustive estimates. The two estimates that we are concerned with are the mean and variance (estimate of the mean, estimate of the variance), and those happen to be exhaustive in a mathematical sense when calculated from the normal distribution, but not from other distributions. If they are exhaustive, then it is known that given these two quantities, \bar{X} and s^2 , the distribution of any other statistic whatsoever (that is to say, any function whatever of the observations) would, subject to the restriction of fixing the values of \bar{X} and s^2 , have a distribution indeed and take many values, but its

distribution would be independent of the unknowns μ and σ . And, therefore, no such value could provide information about μ . But if the statistics used in this argument had not been exhaustive, then it would be possible to find other functions of the observations which even under the restrictions that \bar{X} and s are fixed, would have information to give about the unknown μ . Such a value, calculated from the sample, would define a sub-set of cases which might well give a different probability from that which we have arrived at. So the rigorous application of that third specification of what is needed for a true statement of probability brings in the two requirements for a valid argument of this kind.

Now of course I haven't listed all or anything like all of the fallacies that have been introduced, largely springing from the same roots, but as I suppose is familiar, whether you think of error or whether you think of sin, one leads to another. Once a person has harbored an error in his undergraduate days, carefully implanted there by some distinguished but muddle-headed professor, he may go on for a long while without being enabled to work it out by his own powers of thought. At least it's scarcely conceivable that the mathematicians of the 19th century should have harbored the notion of inverse probability from about 1812, when Laplace published his *Théorie Analytique*, to what I suppose would be the best terminus, 1886, when, speaking of my own country, Crystal published his great *Algebra*, in which he took the unprecedented step of throwing out the whole business of probability altogether as being too hopelessly unsound to be included in a good book on algebra. That was good for the teaching of algebra, and I am inclined to think, though it is a matter of judgment, that it was also good for statistical studies in England. The same movement of thought was going on, to some extent, in other countries, but not quite so abruptly and dramatically as it did in England, and the result in England was that the study of probability, when it

re-emerged from its temporary eclipse, re-emerged well embedded in a much larger discipline which is commonly known as statistics at the present time.

Of course, there is quite a lot of continental influence in favor of regarding probability theory as a self-supporting branch of mathematics, and treating it in the traditionally abstract and, I think, fruitless way. Perhaps that's why statistical science has been comparatively backward in many European countries. Perhaps we were lucky in England in having the whole mass of fallacious rubbish put out of sight until we had time to think about probability in concrete terms and in relation, above all, to the purposes for which we wanted the idea in the natural sciences. I am quite sure it is only personal contact with the business of the improvement of natural knowledge in the natural sciences that is capable to keep straight the thought of mathematically-minded people who have to grope their way through the complex entanglements of error, with which at present they are very much surrounded. I think it's worse in this country than in most, though I may be wrong. Certainly there is grave confusion of thought. We are quite in danger of sending highly-trained and highly intelligent young men out into the world with tables of erroneous numbers under their arms, and with a dense fog in the place where their brains ought to be. In this century, of course, they will be working on guided missiles and advising the medical profession on the control of disease, and there is no limit to the extent to which they could impede every sort of national effort.

CRYSTALLOGRAPHY: A BORDERLINE SCIENCE

Dame Kathleen Lonsdale

MOST PEOPLE except scientists think they know the difference between a solid and a liquid. A solid normally has a fixed size and shape. The volume of a liquid remains constant except when it is subjected to considerable force, but its shape alters to fit the vessel that contains it. But what about a glacier, that is made of ice but flows like a very viscous river? When glass is softened by heating, at what stage does it become a liquid? What are putty, paper, hair, silk, rubber, wool, and the whole family of plastics? The crystallographer has at least a partial answer to these problems. The atoms or molecules in a *solid* are arranged in a regularly repeating, symmetrical pattern (Figure 1). If the solid is heated, the temperature at which the regularity breaks down and atoms or groups of atoms begin to roll over each other and exchange places, is called the melting-point. In a liquid there is no permanent regularity, although small, partially-regular groups may form and disperse (Figure 2). The atomic arrangement in a glass also lacks regularity but cannot change until the amplitude of thermal vibration is sufficient for the glass to soften and to behave like an extremely viscous liquid that, at higher temperatures still, becomes a normal liquid. There is no definite melting-point. Glass is a liquid, but it is a liquid in which the thermal movements of the atoms are so small that they very rarely exchange places; their irregularity of position has become, as it were, frozen in. Given time, a very long time indeed, glass will de-vitrify: that is, it will become a true solid, with a regularity of atomic arrange-

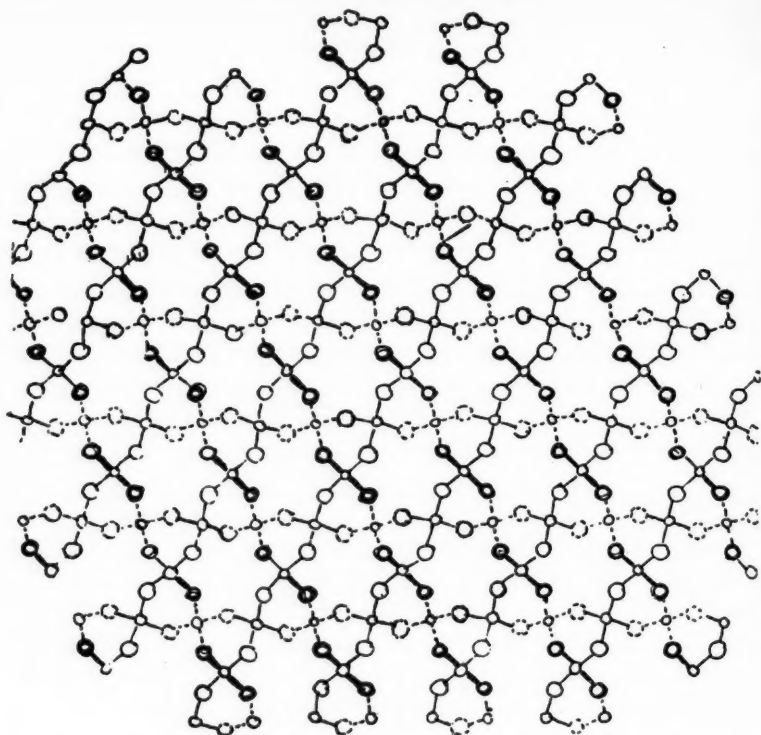


FIGURE 1. Diagrammatic representation of the atomic structure of quartz.

ment. But it will then be a mass of very tiny crystals (crystal-lites), all differently orientated because devitrification will have begun at many centers; and it will have lost its transparency. It is an interesting fact that water, when pure, rather easily *supercools*; that is, it remains a liquid even below its normal freezing-point. Many clouds consist of tiny droplets of supercooled water at temperatures well below 0°C . This is the basis of modern rainmaking by airplane, because such supercooled water droplets can be made to freeze by the sudden lowering of their temperature with pellets of "dry ice" (solid carbon dioxide), and the real ice crystals so formed

grow larger and fall as snow or melt on the way down and fall as rain.

Mathematicians interested in natural crystals have realized for some time that their external forms give evidence of internal periodicity of structure. Although different specimens

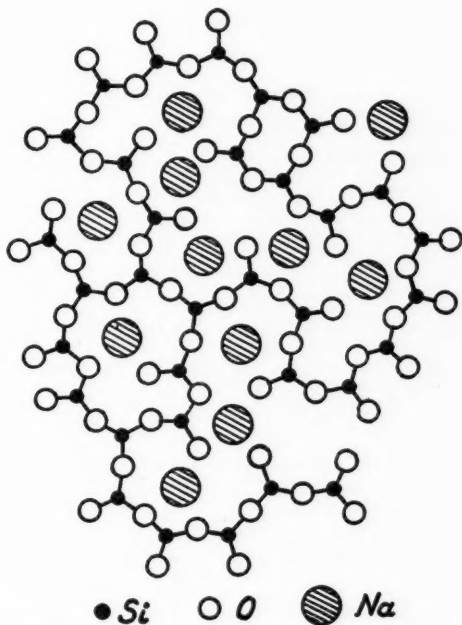


FIGURE 2. Diagrammatic representation of the atomic structure of glass.

of the same kind of crystal, say alum, may have facets of different shapes and sizes, yet the angles between the normals to the facets are constant from one specimen to another ("Law of Constancy of Interfacial Angles"). Moreover there are only certain kinds of symmetry that occur in crystal forms. Crystals never, for example, have fivefold or sevenfold symmetry. The kinds of symmetry that do occur are those typical of infinite space lattices ("translation groups"), that

is, of systems of points each having an environment precisely similar to that of every other point. If one imagines each point to be replaced by an atom or group of atoms, then the resulting pattern would be both symmetrical and periodic. But a diamond is no less crystalline even when it has no external facets, natural or artificially cut and polished; the crystallinity really consists in the internal symmetry and regularity, which is as typical of lead or aluminum as of salt, sugar, or diamond. In other words, every true solid is crystalline; and substances such as silk or paper are semi-crystalline, that is, they have only partial regularity of atomic arrangement, perhaps in only one dimension, or two; or perhaps in three, but only over a very few repeats of pattern.

It follows that crystallography, which is the study of the external form and internal structure of crystalline substances with or without external facets, and of the relationships between the molecular structure and the properties of the substance (physical, chemical, mechanical), since it deals in general with *solids*, is not merely a science in its own right, but an essential part of nearly every other science also, and a useful tool in most industrial research laboratories. In colleges and universities, crystallography is taught in departments of physics, chemistry, mineralogy, engineering, metallurgy, biophysics, meteorology, and textile studies.

In this article, it will be possible only to take a few examples of the impact of crystallographic research on different disciplines, but it should be clear that these examples are typical of many others that might have been chosen.

The study of the atomic arrangements in all solids was possible as soon as it had been proved that X-rays (and later electrons and neutrons) could be diffracted by crystalline substances. The process of *diffraction* can be illustrated by means of a very simple experiment. If a bright point source of light at some distance away is looked at through a fine handkerchief (or other two-dimensional network of holes),

what is seen is not one light, but a pattern of bright lights. The finer the handkerchief, that is, the closer the holes of this simple *diffraction grating*, the wider apart are the bright points in the *diffraction pattern*. This is a direct consequence of the wave nature of light itself. Each aperture in the network acts like a source of light waves spreading in all directions, but these secondary light waves in general interfere with each other and cancel out to give darkness; they reinforce each other only along particular directions (see Figure 3) to give a pattern of diffracted beams. In the same way each

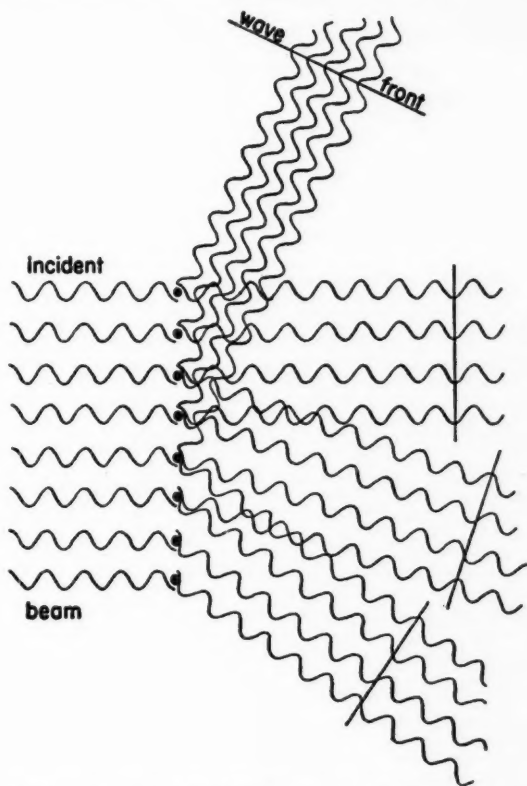


FIGURE 3. Scattered rays showing directions of reinforcement and interference.

atom, when the original beam of X-rays is incident upon it, acts as a secondary source of X-rays; and the crystal as a whole acts as a three-dimensional diffraction grating to give an X-ray pattern which can be recorded either photographically or by means of the ionizing effect of the individual diffracted beams (Fig. 4, p. 281). Liquids and amorphous or glassy solids give only a single hazy cone of diffracted rays, recorded as a ring (Fig. 5, p. 282) on a photographic film (or two or three very diffuse rings); crystalline powders and conglomerates of tiny crystals, the normal texture of massive metals, give many sharp rings (the sharpness decreasing as the individual crystallites approach colloidal dimensions, say, less than 0.0001 mm. each way; whereas the rings break up into little spots if the individual crystal grains are bigger than 0.01 mm. across); single crystals give patterns of sharp spots. Various techniques (X-ray beam having a range of wave lengths or a single wave length; crystal and recording device, stationary or moving synchronously or separately; and so on) can be used to obtain different types of pattern, all of which yield particular types of information. In general, however, it may be stated that:

(1) The *shapes* of the diffracted beams give information about the crystal texture, that is, whether the specimen is a perfect single crystal; a mosaic of differently orientated crystallites; a powder consisting of separate crystallites, large, medium, or very small in size; a fibrous or platy semi-crystal having regularity only in one or two dimensions but not in the third; and so on. (Notice the distinction between *texture*, so defined, and *structure*, which is the arrangement of atoms within the crystal or crystallite.)

(2) The *positions* of the diffracted beams give information about the crystal geometry, that is, the shape, size, and symmetry of the unit of repeat.

(3) The *intensities* of the diffracted beams give information about the distribution of scattering material in the unit cell. In the case of X-rays this means the distribution of elec-

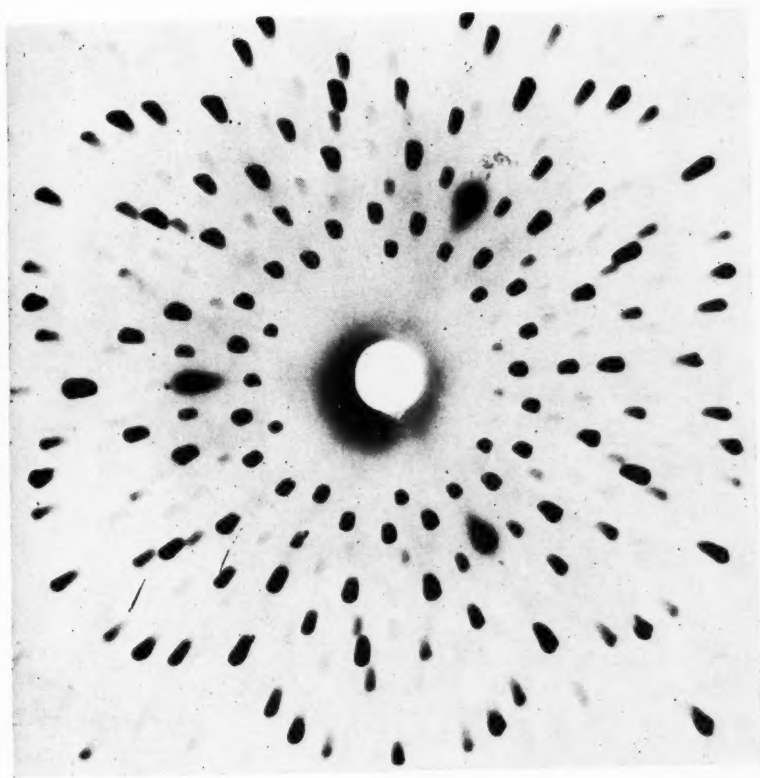


FIGURE 4. X-ray photograph of a single crystal of quartz.

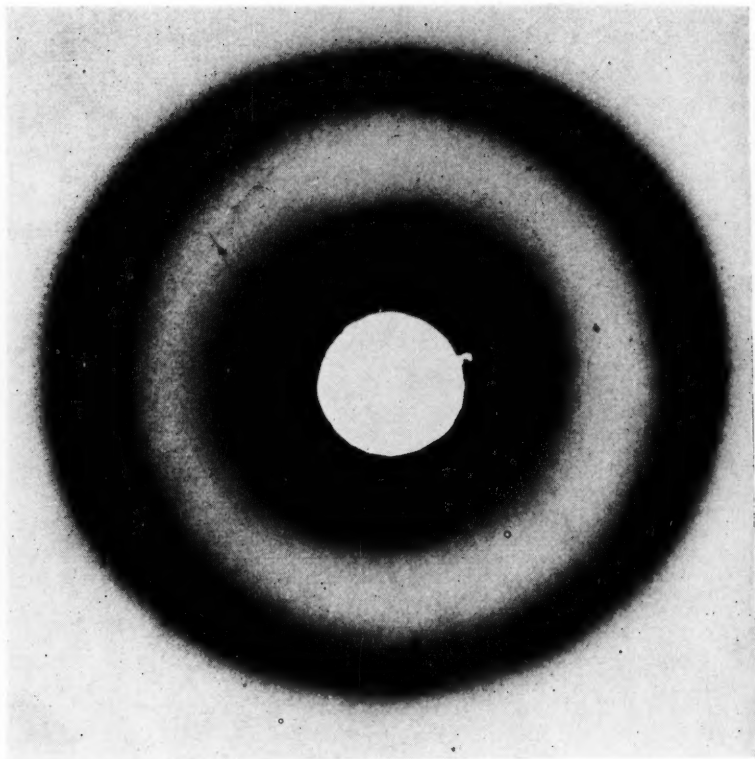


FIGURE 5. X-ray photograph of a stream of liquid air.

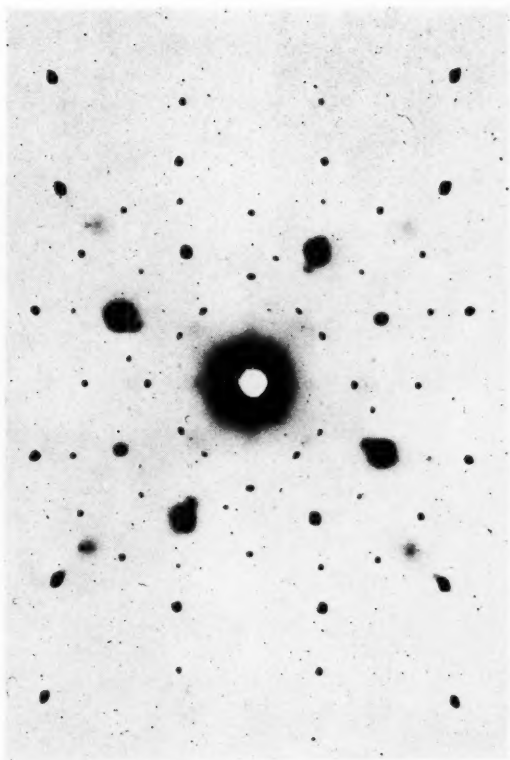


FIGURE 9. X-ray photograph of pentaerythritol, showing sharp and diffuse spots.

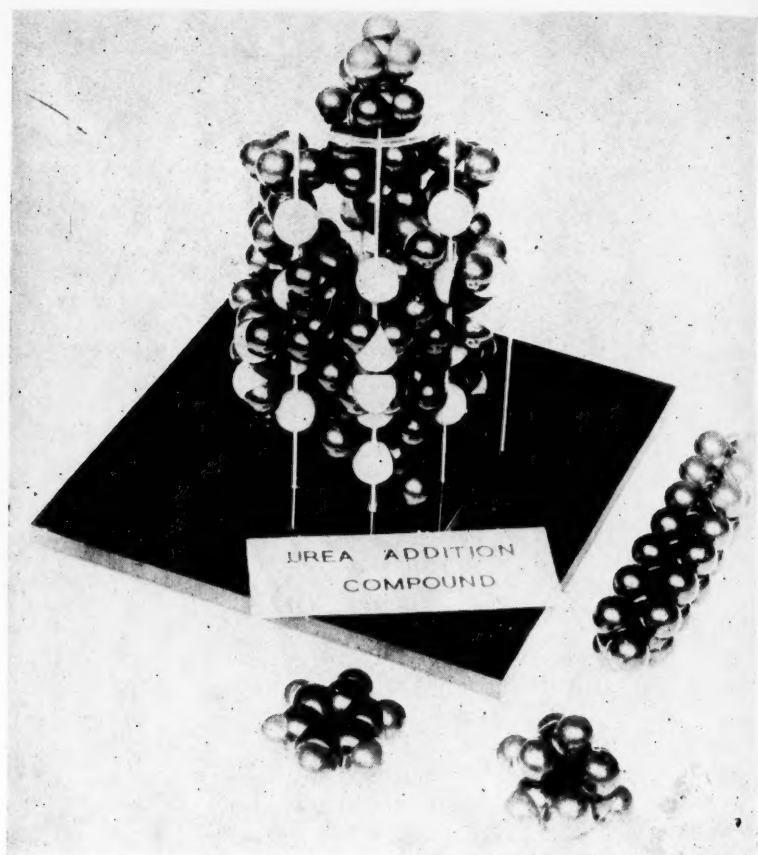


FIGURE 13. Urea-paraffin adduct, showing a "straight" chain which fits into the urea cylinder, and branched chains which do not. (One is being tried.)



FIGURE 14. Single crystals of haemoglobin, of lengths varying between 0.01 and 0.5 mm.

tron density, and hence the relative positions of all atoms. Electron beams are easily absorbed and can only be used to investigate films, surfaces, or extremely small crystals such as occur in "smokes," but they give information about the distribution of the field of force due to the whole atom, nucleus and electrons combined. Neutrons locate only the atomic nuclei, except in the case of strongly magnetic atoms (those in which there is an unbalanced spin or orbital moment of electrons in the third or fourth shell), for which they can be used to locate the orientations of the magnetic moments, if these are ordered, as they are in ferromagnetic or anti-ferromagnetic substances. The orientation of the "atomic magnets" in anti-ferromagnetic crystals, where there is anti-parallel ordering of the moments (Figure 6), is particularly

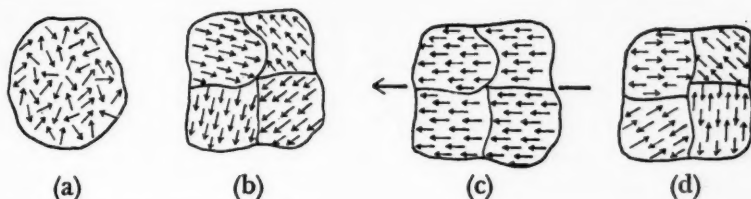


FIGURE 6. (a) paramagnetic
 (b) ferromagnetic, unmagnetized mosaic
 (c) ferromagnetic, saturated in external field
 (d) anti-ferromagnetic mosaic, unaffected by an external field.

difficult to determine by other methods, since such an internally compensated system does not respond to an externally-imposed magnetic field.

It will be clear that (1), the ability to obtain information about texture, makes crystallography an important tool in the science of engineering, especially in the field of metallurgy. The effects of cold-working, of heat-treatment, and of ageing can all be studied for various metals, alloys of varying compositions, and other solid materials. The differences in

mechanical behavior of metals in the form of single crystals and of massive, consolidated conglomerates of tiny crystallites or of little platelets embedded in a matrix of different composition can be predicted or explained.

The habits (growth forms) and textures of ice crystals are important to the study of cloud physics and of rainmaking, already mentioned, and also to the understanding of the behavior of glaciers. The ice crystals in the upper parts of a glacier are small and disorientated, but the molecules are easily transferred from the surface of one crystal to another. Ice crystals show easy glide on their basal plane, that is, normal to the hexagonal axis, but not in other directions. Those crystals that are so orientated that glide takes place easily, under the pressure of ice and snow higher in the glacier, grow at the expense of those less favorably orientated, until near the foot of the glacier the ice crystals are several centimeters across and nearly all orientated in the position of easy glide.

The study of (2), the geometry of crystals, is, from the theoretical point of view, a branch of pure mathematics: the study of translation groups, point groups, and space groups. In fact the mathematical theory was fully worked out long before the first diffraction experiments were undertaken. It had been shown that there are 14 three-dimensional lattices (translation groups), 32 point groups, and 230 space groups. (See Figures 7 and 8) The unit cell of any lattice is characterized by six unknowns: a, b, c , the edges of the unit cell; and α, β, γ , the angles between those edges taken in pairs. Hence the volume of the unit cell may be determined: and given the density, the weight of scattering material in the unit cell is known. The space group gives the complete symmetry of that quantity of scattering material, but without specifying the details of its arrangement.

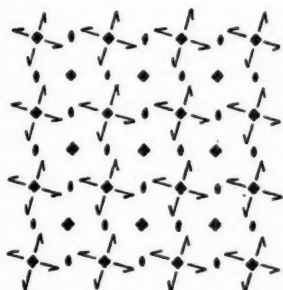
The study of (3), the distribution of scattering material in the unit cell, means that in principle the positions of all nuclei and electrons are known, relative to each other; that the



- (a) Part of one net of an infinite translation group (2-dimensional and square for simplicity).



- (b) A point group having 4-fold rotational symmetry about the point.



- (c) A space group, based on a square net and the above point group. The whole (infinite) space group will have 4-fold rotational symmetry about *any* point of the net and also about any center of a square of points.

FIGURE 7

One unit cell of a space lattice, showing the axial lengths (translations) a , b , c , and the axial angles α , β , γ .

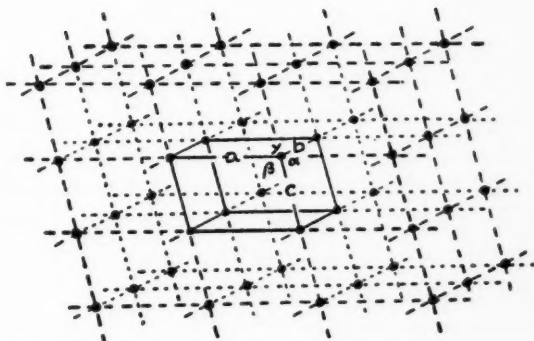


FIGURE 8. Space lattice, showing unit cell.

kinds of atoms present and their state of ionization and vibration can be determined; that the nature of the forces between them can be investigated; and that groupings of atoms to form molecules can be studied in detail. A complete structure analysis may involve the measurement of intensities of hundreds or even thousands of diffracted beams. Elaborate mathematical techniques are needed to work back from these experimental data to the three-dimensional atomic "diffraction grating"; fortunately high-speed computers can now eliminate much of the drudgery involved. The resulting structure is often plotted in the form of a contoured electron-density map. (Compare Figure 12)

It was rather natural that the early X-ray crystallographers should have been physicists, because the equipment required for their experiments was of the kind normally found in a physics laboratory and the theory of X-ray diffraction by crystals was simply an extension of the theory of optics. From the very first, however, it was realized that atoms in crystals were not stationary, but vibrating; and the study of crystal dynamics is one that has interested mathematical physicists over the past forty-five years.

On certain types of X-ray photographs there are not only sharp spots but diffuse spots and streaks which tend to disappear at low temperatures and to become greatly enhanced as the temperature is raised and especially as it approaches the melting point (Fig. 9, p. 283). These diffuse spots and streaks are due to diffraction by the harmonic waves into which the thermal movements of atoms and molecules can be resolved. The elastic waves are those of lowest frequency and, in general, of highest amplitudes, and it has been shown that, at least in the case of simple structures, it is possible to determine elastic constants for the crystal from the intensities of the diffuse spots. It is also now possible, though at present also only for simple structures, to determine the average amplitudes of vibration of individual atoms in different direc-

tions, and in the case of molecular crystals to relate these to the translations and librations of the molecules as a whole.

Chemists very soon realized that the information being obtained by X-ray crystallographers working in physics laboratories was of great interest to them. They and the mineralogists provided the crystals, which are not normally part of the physics laboratory equipment. Later the chemists themselves learned to use the X-ray methods; and most of the problems of structure analysis now being tackled are problems of stereochemistry. Within a year or two of the discovery of X-ray diffraction in 1912, sufficient ionic compounds had been examined for it to be clear that in such crystals there are no separate molecules. In sodium chloride, for example, the sodium and chlorine ions are arranged alternately, like the black and white squares in a chessboard, but in three dimensions. Each sodium ion is surrounded by an octahedron of six chlorines, each chlorine atom by an octahedron of six sodiums. (See Figure 10)

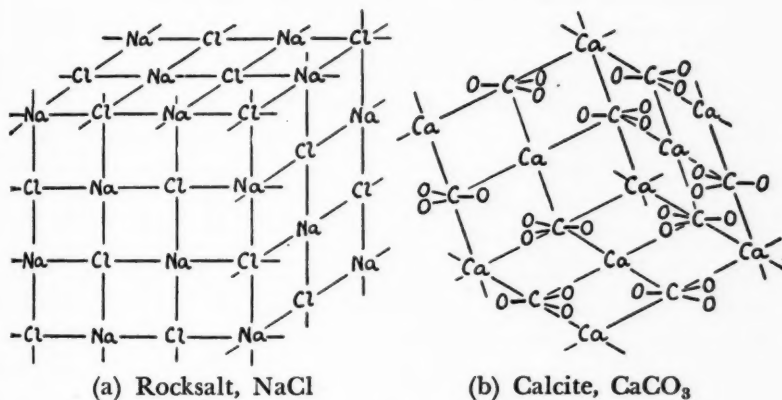


FIGURE 10

In calcium carbonate there are ionic groups $(\text{CO}_3)^{++}$, which alternate with calcium ions in a kind of deformed NaCl-type structure having a pronounced cleavage. The

presence of cleavage planes, along which the crystal splits very easily, is a sign of weak forces between such planes, which are themselves densely populated with atoms.

Nearly all minerals, in fact, are of this non-molecular type, and it is sometimes possible for ionic exchange to take place, one kind of ion being displaced by another without the breakdown of the whole system. This, of course, is the principle of the water-softening zeolites, and it is also the basis of the relative dating of ancient bone materials in a particular locality by the measure of the extent to which fluorine has replaced hydroxy-ions. It was a study of this kind that first helped to raise doubts concerning the authenticity of the skull found at Piltdown, England, originally believed to be that of the most primitive known man, but afterwards discovered to be a pure fake, a gorilla's skull with doctored teeth.

The structures of many molecular compounds have now been determined. Exact shapes and sizes of chemical molecules provide bond lengths and bond angles for the mathematical chemist to consider. In the case of complicated molecules such as penicillin or vitamin B₁₂, crystallographic research has provided chemical information to supplement standard methods of chemical analysis. Moreover the photograph of the X-ray diffraction pattern of any powdered crystal is unique to that substance and can be used to identify it. This so-called "fingerprint" method of identification is standard technique in many industrial laboratories; it requires only a minute quantity of material, is non-destructive, and identifies the particular crystal modification (e.g., calcite or aragonite, for CaCO₃) as well as the material itself. After the March, 1954, H-bomb test at Bikini, for example, the dust that fell on Japan was found, by X-ray identification techniques, to contain grains of calcite, whereas it was known that the atolls that went up in the explosion were largely composed of aragonite. The inference was that owing to the

high temperature reached, the CaCO_3 had completely decomposed and then reformed and recrystallized in the alternative modification. In another field, the mineral content of the paint from doubtful "old masters" can give clues as to the dates when the paintings were made. The substances deposited inside industrial ovens or pipes can be identified. The exact composition of alloys can be checked. Quantities of chemical compounds too small even for a melting-point determination or for micro-analysis can be identified with complete certainty. It is not necessary to know the crystal structure, of course. Complex biological substances can be compared and matched by the same fingerprint method that is used to prove that a man-made diamond really is diamond.

This mention of various modifications leads on to the observation that a solid substance does not necessarily melt when the thermal vibrations become so large that a particular atomic arrangement becomes unstable. It may rearrange itself in a new but still crystalline form. Such transformations can be fast and reversible if only second-order changes of arrangement are involved, or they may involve slow and irreversible first-order changes; and sometimes the solid may be dimorphous or polymorphous, more than one form being stable under one set of conditions. Quartz is dimorphous, but SiO_2 is polymorphous, α - and β -quartz being only two of its forms. The change from α - to β -quartz is a second-order one, involving only small movements of atoms, but the change from quartz to tridymite or to cristobalite would mean a first-order change, involving the breaking and reforming of atomic bonds (Figure 11). Recently it has been found that ice, normally *hexagonal*, though with several less symmetrical high-pressure forms, can also be *cubic* when deposited at low temperatures and pressures and at a particular rate. It has also a glassy amorphous form, having rigidity but no symmetry or periodicity, when it is deposited suddenly from vapor at very low temperatures.

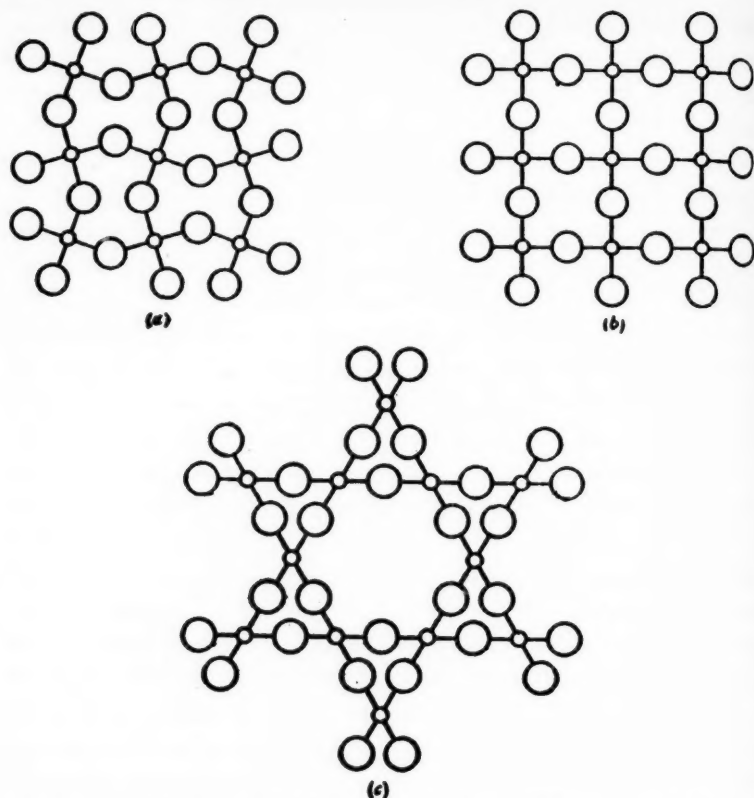


FIGURE 11. (a), (b), and (c) represent three different varieties of pattern of a 2:4 coordinated structure in a plane. (a) and (b) differ only in the linkage of the 2 coordinated member; (c) differs from both of them by the different topological arrangement of the 4 coordinated groups. The transition (a) \rightarrow (b) may therefore be expected to be rapid and reversible; (a) \rightarrow (c) or (b) \rightarrow (c) to be sluggish and slow hysteresis. In the first case the transition does not involve a change of neighbors; in the second it does.

Changes in the magnetic condition—for instance, from paramagnetic to anti-ferromagnetic—can be followed by means of neutron diffraction. X-rays show only second-order changes of the unit cell geometry, but with neutron diffrac-

tion large new peaks appear, indicating a major change of arrangement. This change, however, is in the *directions* of the atomic magnets, not in the *positions* of the atoms, which move only a little. Many of the industrially important *ferrites* are difficult to study by X-ray methods for another reason. The atoms that occur in them (Cr, Mn, Fe, Co, Ni) are close together in atomic number and are therefore difficult to distinguish from one another by their scattering power for X-rays. But they scatter neutrons very differently from one another. So also do Fe^{++} and Fe^{+++} , because of their different spin states. Neutron and X-ray diffraction may frequently be used to supplement one another, one method achieving what the other cannot.

Neutron diffraction, for example, can be used to locate the positions of hydrogen atoms or ions, which is difficult or sometimes impossible to do by means of X-rays, especially in the presence of heavy atoms. A combination of the two methods, therefore, has been used to carry out the structure analysis of ferroelectric materials, where the arrangement and movements of hydrogen atoms is sometimes the clue to their peculiar and industrially important electrical properties.

The structural analysis of chemical compounds, either to give precise molecular dimensions and vibrations or to give the exact stereochemical configuration of increasingly complex materials in the solid state is, however, the field in which the most spectacular advances have been made in the forty-five years since the first experiments of young Max von Laue and his even younger colleagues, Friedrich and Knipping, were made.

Penicillin (Figure 12), a joint Anglo-American effort, and vitamin B_{12} , the work of Dorothy Hodgkin and her colleagues, have already been mentioned. A concerted attack is now being made to unravel the complex structure of proteins, both globular and fibrous. Electron microscope pictures have given valuable information about the macroscopic

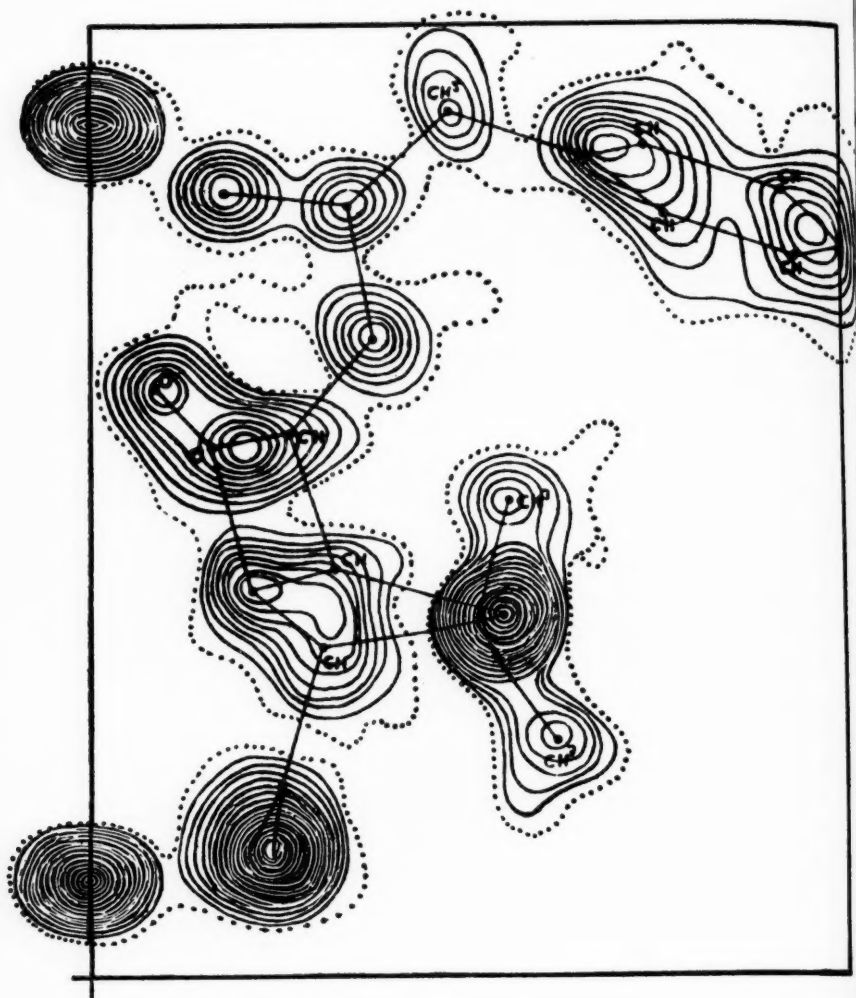


FIGURE 12. Electron density distribution in the molecule of benzyl penicillin.

shape and arrangement of protein molecules, but as yet there are only glimpses of the details of their internal structures.

New types of structure have been found. There are the clathrate compounds, where one kind of atom or molecule is trapped inside a closed cagework composed of some entirely unrelated substance: a rare gas, for example, inside a quinol framework which, when chemically or mechanically broken down, releases some eighty times as much gas as could be accommodated in the same space under normal pressures. The clathrate compounds, however, are but one example of a large family of mixed molecular compounds that exist only in the solid state: flat molecules that crystallize alternately in sheets, or molecules that form cylinders into which other linear molecules can fit. One such system of urea-paraffin adducts provides a means of complete separation of straight and branched-chain paraffins out of a mixture of the two. The straight chains can fit into urea cylinders and will crystallize out, leaving the branched chains, which cannot fit in, behind in the solution. (See Figure 13, p. 284)

The study of proteins, which has received a great impetus within the last few years by Pauling's suggestions regarding possible spiral formations of long-chain proteins, involves many substances of interest to the biochemist and to the biologist, and naturally also the field of medicine is involved. Viruses, vitamins, haemoglobin (Fig. 14, p. 284), nucleic acid and ribonuclease, insulin and carcinogens, and various drugs and insecticides are all being studied.

The paleontologist is interested in the crystallographic study of fossils, the soil scientist in the study of clay minerals and rocks. Perhaps it is the structural analysis of the silicates that has provided the most finished example of the crystallographer's art; for the silicates, the most abundant constituent of the earth's crust, were a chemical riddle until X-ray analysis showed them to be built up on various types of

framework, the architectural simplicity of which both conceals and reveals their amazing beauty. (See Figure 15)

It may, indeed, be the fact that crystallography is aesthetically satisfying as well as intellectually stimulating that is the reason why a relatively high proportion of women scientists have adopted it as a field for research.

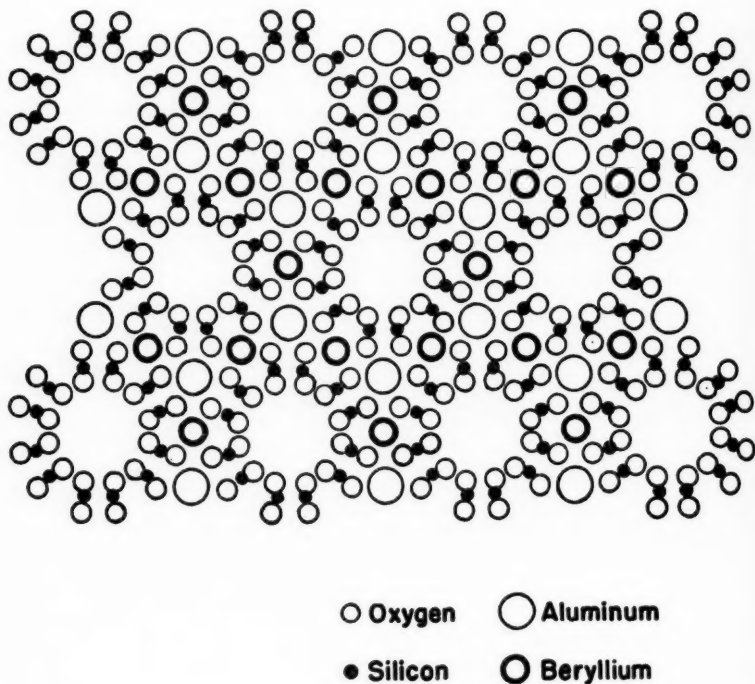


FIGURE 15. The structure of the mineral beryl, $\text{Be}_3\text{Al}_2\text{Si}_6\text{O}_{18}$.

THE IMPENETRABLE FRONT

*Arthur E. Adams*¹

OBVIOUSLY NO ONE can see enough during a short visit in the Soviet Union to come away with sound conclusions on all the most vital questions. Often I have taxed the patience of my classes by pouring invective upon the heads of journalists and congressmen who return after a flying tour through the land of "riddle wrapped in enigma" to expound the final truths they have uncovered. But now I am in the position of my erstwhile opponents, the omniscient travelers. I want to talk about *my* trip.

It could be supposed that some ten years of Russian studies would have sharpened my perceptions and have provided a solid basis for judging what I saw. But one man's observations during a month in Russia can never be more than a one-sided glimpse of a frightfully complex civilization; therefore I lay no claim to expertness. However, from a hectic four weeks of almost frantically looking in all directions and asking questions with as much system as was possible under the circumstances, I carried away many distinct impressions. In some cases, conditions I had previously known to exist without quite believing them possible were proved at a glance; at other times, seeing the reality compelled me to question the accuracy of some scholarly analyses published in the West. Out of the mass of impressions, certain patterns formed which seem to me to be of interest. I offer them here, not as

¹ The author visited the Soviet Union from August 29 to September 25, 1957. For fifteen days he traveled with a group of three other tourists, including a fellow Russian historian, Professor Charles Morley of Ohio State University. During the remainder of his stay he traveled alone, usually without a guide.

the reliable conclusions of scholarly research, but as the impressions of a hurried traveler who found the people and the nation different in many ways from what he had expected.

I

Since Adam left Eden, it has been the custom of naive travelers to return from a first visit to a foreign land, bearing happy stories about the "friendliness of the natives." At the risk of appearing to crack an old chestnut once more, I must admit that my first and most lasting impression was that the Russian people are the most warm-hearted, hospitable, and out-going people I have ever met.² In every meeting there came from the Russian side a vigorous effort to establish an atmosphere of friendliness, an effort to achieve rapport based on perfect frankness, as if the individual Russian could not endure cool or formal relationships. Expecting hostility, suspicion, bad (proletarian) manners, and surly unhappiness, I was all the more sensitive to their opposites; in consequence, one of my primary objectives immediately became analysis of the causes and elements of this "friendliness."

One component appears to be the highly-developed, delightful, and often obsequious manners that have carried over from the aristocratic heritage of Imperial Russia. The polished courtesy produced by a lord-and-subject society and skillfully practiced by the subject can be thoroughly charming. The porter on the train from Helsinki to Leningrad, my first "real Russian," a hard-pressed little man with a sad

²In the following pages I have tried to present typical examples drawn from the principal social and economic strata of Soviet society. I talked with approximately 200 Soviet citizens for periods that varied from 15 minutes to several hours; thus my interviews were irregular in quality and in some cases amounted to only a few questions and answers. Moreover, the "sample," if it may be so dignified, was badly truncated, for I interviewed no members of the political and economic elite. I have sought to correct these and other shortcomings by comparing my experiences with those of other students of Russia who visited the Soviet Union during 1956-1957. Extended comparison was effected at a conference of scholarly travelers to the Soviet Union which met at Chicago in December 1957 under the sponsorship of the Carnegie Corporation.

Buster Keaton face, quailed before station officials at every stop. But he gaily broke me in to Russia's engaging manners, which he managed with all the grace of any down-at-heels nobleman out of Tolstoy or Chekhov. He explained the operation of his shiny coke-heated samovar as though it were his proudest possession. He made me taste his tea, politely smoked my cigarettes while apologetically admitting that he preferred the Russian tobacco because he was used to it, and most enthusiastically posed for his photograph with the chubby steel-toothed girl porter from the next car. Between stations, he came back to lean on the compartment door, to ask questions and make jokes. Traveling with him, I felt more like a guest in a private home than a foreign traveler in a hostile country, and I left the train warmed by what seemed to be genuine friendliness. It is still difficult to suppose that he was simply performing his job as well as he could; yet it is impossible to decide where the intangible line separated official courtesy from simple kindness.

Another element in the manifestations of friendliness that came my way might be characterized as a sort of intellectual affinity existing for a great variety of reasons between Russians and Americans. In a Leningrad hotel restaurant I listened to a small orchestra playing American jazz—not well, but enthusiastically. During an intermission, I asked the drummer, a pale-skinned man of thirty, what he thought about American music. "Wonderful," he said. "What about Russian jazz?" He was scornful: "We don't have any." Then he proceeded to praise the talents of two American jazz musicians, Stan Kenton and Art Blakey, whose names I confess I had not heard. At the next intermission he came looking for me in the lobby and eagerly invited me for a walk. Out on the dark streets he talked about his family, about the poor quality of musical instruments made in the Soviet Union, about the unpleasant overtones of his homemade cymbals, and he protected me from the staggering drunkards

we met as if I were a close and somewhat helpless friend. Still later he sought me out again. Would I like to hear him play a special American arrangement on his drums? Since a car was waiting to take me to the train, I regretfully begged off; then curiosity won its argument, and at the last moment I hurried into the restaurant and took a table by the door. In the middle of a number the drummer began whistling for the leader's attention; within seconds, drummer and pianist were deep in a duet of tin-pan alley jungle music. The drummer played well, looking earnestly in my direction like a child starved for its parent's approval. When I clasped my hands over my head at the finale, he bowed his thanks and waved goodbye as though we were old, old friends.

Why the swift offering of confidences? The desire to talk? The wish to be approved? In this case I could only assume that the drummer's admiration for American music and American musicians was so strong that it simply extended itself to personal friendliness toward Americans themselves.

There was no doubt that the government had the red carpet out for American visitors, and sometimes the formal cordiality of guides and Intourist officials, hotel managers, and waiters seemed like a wall of ceremony built to prevent contact with the rough Soviet reality. Yet each outside contact made this interpretation of the official hospitality less acceptable. A few minutes after leaving my drummer, I mentioned to an army captain on the train that I was an American. Since he had recently served with Soviet forces in Hungary there should have been reason for stiffness and restraint; but the captain swung into instant and voluble conversation, showing every desire to compare experiences in foreign countries. He and a little woman assigned to my compartment, who looked like a peasant but who introduced herself as a doctor, sat up for hours while the captain, dressed in candy-striped leisure pajamas, talked gaily about everything but the revolution in Hungary. The doctor said nothing at all, as be-

fitted a lady who had before her the questionable privilege of spending the night in a compartment shared with three American men, but she watched us with eyes as merry and bright as a child's and giggled quietly at every sally. Next morning, with the night safely passed, she worked hard at correcting our Russian, all the while protesting its excellence. One could argue that the good-natured kindness of these people arose because they knew I could not be in the Soviet Union without government approval, and that they were in their own way dutifully extending the official hospitality of their leaders. My own conclusion is that these apparently happy and friendly people, like so many others I met, *were* really happy and friendly.

A conversation on a plane from Moscow to Stalingrad, begun with an engineer and an artist, developed quickly into a general conversation involving half the plane's passengers and lasted all the four hours to Stalingrad. Debating Russia's future political development, we stood in the aisle and leaned over the backs of seats. The plane's navigator joined in, and finally even the pilot came back to listen and grin, while I fecklessly wondered if the plane were flying itself. Only the stewardess failed to get into the talk, but she had her say when we neared our destination. Ordinarily Russians ignore the safety precautions our own airlines practice so religiously. They fly without safety belts or emergency exits, and at most airports they land their big planes on rough ground rather than on concrete runways. But this time the stewardess put safety measures into effect, demanding that everyone sit down for the landing. When, after considerable discussion and dissent, all her passengers had obeyed, she came back to sit with me, to look at the photographs of home and family I carried, to tell me about the Ukraine where she lived, and to ask her own questions. While she talked, I noticed other heads leaning together across the aisle, working out a program; then, with the deci-

sion made and the representative duly elected, the engineer came back to say, formally, "We want to thank you for talking to us. It has been very interesting and profitable." And all the heads down the aisle nodded and smiled. Once again the simple gregariousness of these people, the way their ideas and arguments spilled out of their minds, the way they eagerly caught up the meaning of my hesitant Russian, fully persuaded me that I was among friends.

And the friendliness never lagged. During a two-day boat cruise down the Volga-Don Canal and the Don River from Stalingrad to Rostov, vacationing Russians made the Americans feel "at home." There was always an empty chair in any group, always the quiet continuation of conversation that reached out to make the newcomer a part of the group. Now and again swift and hot debates settled the facts about a passing landmark so that it could be explained accurately to the visitor. And often there were hurried knocks at my cabin door, when someone feared I might miss something of interest on the banks. The captain and the woman who cleaned the cabins were as full of questions as the vacationing professors and traveling actors. A thin girl who served our table worried vociferously about my poor appetite. It has been twenty-five years since I have had the helpless feeling that comes when a well-intentioned woman who has done her best tearfully demands, "But why won't you eat?" Finally, when the boat docked at Rostov, chambermaids and big businessmen crowded around to exchange coins and autographs and offer warm goodbyes. Like the end of a pleasure cruise anywhere in the world, but more touching it seemed to me, for these were Russians—the people supposedly trained by decades of propaganda to hate America and Americans.

The man who carried the baggage, the cab driver, the policeman, the housewife—all wanted to talk. Even primitive and tough Uzbek farmers stared curiously and chuckled at the opportunity to shake hands and answer a question or

two. By the end of the tour, talking to all the people who wanted to talk was hard work. Wearing my baggiest clothing and trying hard to look like a Russian so that I could relax, I boarded the Moscow-Prague plane. Eight or nine strangers, already grouped around two tables in one section of the plane, eyed me uneasily, slow to break the silence. But once we were in the air, a stewardess brought a tray of glasses filled with vodka and the restraint exploded: What was I? "American? Ah, good! A toast: friendship and peace!" We talked our way to Prague.

The gracious Russian manners made every conversation pleasurable, and the search for mutual interests was always fervent and usually successful. Undoubtedly, there was as much curiosity on the Russians' side as on mine, and the government's ostentatious red carpet surely justified and even encouraged the average man to show the foreign visitor every courtesy. But there was more, even in the formal gatherings where professors cautiously voiced their opinions under the eyes of watchful colleagues. Always there was a tacit understanding that as an individual I was not to be categorized as an American, a member of a capitalist state, or an anti-communist, but as a human being. The people were not only willing but anxious to accept the stranger as a man like themselves. That individual Russians so easily leaped the high barriers of hostile ideology and hateful propaganda and so consistently insisted upon putting our relations on the purely human plane seemed to me the best proof of the sincerity of their friendliness.

II

But behind the friendliness lies abysmal ignorance of Western Europe and the United States. We have long known, of course, that the party-government apparatus controls every channel of communication—the press, radio, schools, and in some cases even the invention and circulation of rumors.

We also know that a principal function of this control is to isolate the Soviet citizen from the outside world. Possibly because of a professor's naive belief that the "truth will out," I was amazed by the evident success of the Soviet effort to keep its citizens uninformed. On our side we have heard much about the West's penetration of the iron curtain by means of the Voice of America and other radio organizations. Also, many young Russians saw Western Europe during the Second World War, and still others have observed conditions in East Germany and the satellite states since the war. Further, it seems hardly possible that intelligent and perceptive men would not look behind *Pravda's* "truth" and add the two's correctly for themselves. Logically, we have reasoned, the combination of some information, a little experience, and careful thought must have had an enlightening effect. This conclusion, combined with our own wishful thinking, has helped us to construct a picture of a people at least reasonably well-informed about the rest of the world. Probably such individuals do exist, but among those I talked with, the rule was ignorance. The oldest and most vicious lies about us told by the Soviet press are still the most effective. Their endless reiteration in the papers, over the air, in fiction and films, and most shocking of all, in textbooks and the scholarly works of eminent professors apparently results in public acceptance of a badly lopsided picture of America.

To mention only a single but typical illustration of falsification, I was urged by professors at Kiev to examine a secondary school textbook published by two distinguished scholars.³ The first paragraph of the Introduction establishes the tone and the theme for the whole book: "American imperialism throughout all its existence has proved itself the most evil enemy of freedom and independence. The American imperialists continuously interfere in the affairs of other

³ A. Gulycha and A. Geronimus, *Krakh Antisovetskoy Interventsii S.Sh.A. (1918-1920gg.)* [The Failure of the United States' Anti-Soviet Intervention (1918-1920)], Moscow, 1952.

countries. For this they employ not only diplomatic and economic means, but mostly and above all—direct military invasion, military intervention, the hunger blockade." In the following pages of this work, the Wall Street Imperialists who are supposed to run our country are grimly painted as the master minds behind *all* opposition to the Soviet Union, in 1918-1920, and through the years since then. Thus recent history is falsified, and the function of historical scholarship becomes the manufacture of ammunition for current political warfare. In view of the fact that historical and political studies are thus distorted to suit the changing needs of the party leaders, and that every other means of communication is bent in the same direction, it is indeed surprising that Soviet citizens persist in treating individual Americans as if they were human beings.

The subtle or unsubtle distortion of facts has had its deadly effects upon knowledge. When the friendly people posed their friendly questions, they asked what the government was doing to solve our terrible problem of mass unemployment. To my explanation that the Great Depression was a thing of the past, they listened politely and without argument, but they found my statement hard to comprehend. Soberly, they inquired about the exploitation of the laboring man by Wall Street; more specifically, they wanted to know why we permit men like Ford, Dupont, and Rockefeller "to run loose." My descriptions of powerful labor unions; insurance, health and welfare funds; the American worker's high wages; and the heavy taxes laid on big incomes produced little more than perplexity and disbelief. The Russians were sure the things I described could not be. They argued that American capitalists must inevitably exploit labor at an ever-increasing rate until our starved workers are forced to rebel and create a classless society like that of the Soviet Union. In reply I pointed out that they were chained to antiquated and unrealistic aspects of Marxian theory that Marx himself would have

repudiated had he lived in the 20th century. Though I stressed the extremely wide variations in prestige, privilege, and salary scales which stratify their society, they clung to the view that they are classless while we are divided into exploiters and exploited.

At this point, with the American speaking so ridiculously, tactful Russians usually turned our attention to less dangerous topics. Did I know Dreiser's *American Tragedy*? Wasn't it an excellent description of life in America? Did I enjoy the writings of Upton Sinclair? Jack London? Howard Fast? Such questions, I believe, were not intentionally malicious. On the contrary, Russian people, high and low, are earnestly interested in literature, proud of their classics, and most happy when deep in excited conversation about the virtues of this or that great writer. With their questions, they were boasting of their wide knowledge, of their familiarity with the "best" American authors. They were also quite unconsciously displaying the fact that even in American literature they read only the Soviet-approved side of the story. Incidentally, I met no one who knew of Fast's retreat from communism, although a mild denunciation of him had been printed by Moscow's *Literary Gazette* in August. Late this January, however, the same periodical, in a major critical revaluation, called him a savage, a deserter, a militant Zionist, a swindler, and an opportunist, and mentioned also that he is immodest, discourteous, cheap, wall-eyed, cowardly, dishonest, and indecent. It may be presumed that Fast is no longer publicly admired.

Conversations that did not turn to literature, though continuing in the serious vein, revealed dismaying emphases in the Soviet citizen's image of the United States. One topic often mentioned was American gangsterism and the American lack of respect for law and human life. As one pleasant but perturbed young lady put it: "But you have so many murders in America!" The corollary assumption, sometimes

stated explicitly, was that in the Soviet Union there are no murders and hardly any lesser crimes. A second favorite topic was the Negro problem. Its nature is only vaguely understood. Though few people spoke of segregation, many referred to our "numerous lynchings." Nor was there any desire to examine seriously the economic, social, and historical complexities of the problem which make its solution so difficult. In the minds of the Russians I met, the Negro problem is an evil—to be condemned, not understood. The third topic of most general interest is, I think, prompted by the Soviet obsession with spies and is a projection to other peoples of practices that have been widely employed by the Soviet administration. The most up-to-date persons mentioned J. Edgar Hoover, the "chief of the American secret police," in the same breath with Senator McCarthy. Apparently the spirit of McCarthy is presumed to live on in Hoover, who is generally believed to head an incredibly vast spy network having as its single aim the destruction of the communist world. In the face of insistence (based, I think, on ignorance and honest conviction) that the Soviet secret police no longer functions, it was impossible to talk on this subject. For one who believes intelligent solutions to the world's problems can only be founded upon man's ability to learn and know the truth, the deliberate communist effort to create a deformed and threatening image of America in the minds of the Soviet millions must be judged one of our century's great political crimes.

III

I found no clear evidence of deep dissatisfaction or violent dissent. Though I probed hard in conversations with groups and with individuals, and though now and again interesting but mild criticisms were offered, I found no sign of revolutionary unrest. True, when I insisted upon criticizing Khrushchev or argued the necessity of a free press, there were

consistent silences; men who agreed with me *may* have been afraid to say so. At least once I was told rather sternly that the Russians, like any other people, prefer to discuss their "family troubles within the family."

Once again, the reality was not what I had anticipated. Since Stalin, we know, the individual's feeling of personal insecurity has been calmed by official condemnation of illegal police and court procedures, and by the virtual suppression of the arbitrary arrest and exile system, the terror that characterized the 30's and 40's. Criticism of the more unpleasant aspects of the Stalinist era has been permitted, and this comparative relaxation continuously tempts some critics to leap official bounds. Early in 1957, for example, Moscow literary figures published an anthology that mercilessly dissected the principal shortcomings of Soviet life; then, university students at Moscow and Leningrad demonstrated against the Hungarian repressions; and humble but important scholars rose to protest and attempt revision of Stalin's version of communist history. Even Ilya Erhenburg, the famous Soviet journalist known best for his ability to blow with the communist wind, turned to face the full blast of that wind. In an article called "Lessons of Stendhal," published in mid-1957, he coolly quoted and approved Stendhal's argument that tyranny is tyranny no matter what the personality of the tyrant. These and other similar events had led me to expect openly expressed dissatisfaction.

Instead, there was a terrifying lack of individual criticism, an almost unbelievable degree of approval for party and government. Because the average Russian is still afraid to voice his opinions, particularly before a stranger? Possibly. The heavy authoritarian hand still rules Soviet society. However, though the element of fear cannot be ignored, there is another explanation that needs to be emphasized. The fact is that the Soviet people, to a remarkable degree isolated from the rest of the world, *appear to believe theirs is the good life.*

Despite drab streets, ugly clothing, unremitting work, and crowded living quarters, they appear to take great personal satisfaction from a conviction that they live in a country that is moving forward. Such visible signs of growth as the miles of new apartment buildings, the rebuilt cities, the TU-104 jet, and other scientific victories over the West seem to individual Russians to be clear evidence of their own advancement. If they needed further demonstration of progress they got it in generous measure when Soviet satellites began to circle the globe.

At one point in a discussion with several men, I ventured the hope that with Stalin gone and with the general tone of life improving, the Soviet system might develop its own multi-party system. My comment disconcerted them, and they asked why I anticipated such an "unnecessary" development. Playing the devil's advocate, I argued that, given the character of early bolshevik ambitions, Lenin and Stalin had been necessary in their time. Only Lenin could have driven the bolsheviks to power; only Stalin could have forced the country through the hard steps it had to take to achieve great economic and military strength. But now, with the war won and Russia's strength at a crest, with numerous highly educated managers and professionally trained technicians, the Soviet Union should be able to lighten the pressures of dictatorship, to ease restraints upon thought and the expression of thought, to give its citizens more of the essential individual freedoms. Perhaps, I argued, the absolute dictatorship of one party was no longer essential; perhaps there could be a steady development of free speech, a greater participation of the people in government, even the development of opposition parties.

One man, a professional pianist, made himself the spokesman for the group. "You must understand," he said. "I am not a communist. None of us are. But we know that the people in the party are the most industrious, the most intelligent, the most devoted. We trust them. We know that whatever

they do, they act for our best interests. All of us in Russia, the workers and the peasants, know that the party works for us. Why would we want another party?" Though the pianist's comment smacks of the pre-revolutionary peasant's quaking devotion to the little father, Tsar Nicholas II, I do not think he was acting as a ventriloquist's dummy for the party, nor deliberately mouthing approved doctrines to deceive a gullible American. The earnestness of his argument, as well as the zeal with which the others joined in to explore and debate the various aspects of my views and theirs was quite unrehearsed. These men may be the intellectually stunted victims of super-efficient indoctrination techniques, but they believe the doctrine and they are happy in their faith.

I explained the Western conviction that unchecked authority must sooner or later be corrupted by its own power. Since the best evidence of such corruption in this age is the rule of Stalin, and since Khrushchev brilliantly castigated the personality cult, the megalomaniac rule, of Stalin at the XXth Congress of the Communist Party, in February 1956, I used Khrushchev's examples. He had admitted that other party members, while despising Stalin's rule, kept silent because of fear. My acquaintances knew of Khrushchev's speech, and they had lived through those years when the ill effects of capricious terror were too obvious to deny. "But," they argued, "Stalin is gone. The cult of personality has been publicly condemned by the party. The party will prevent the recurrence of such crimes."

This faith in the party appeared to extend to Khrushchev and his administration. Criticisms I elicited were minor and local. What impressed me most of all was what might be called the total conviction that the Soviet Union is right in all things, large and small. A college girl, while bravely admitting Stalin's errors, assured me: "We don't have any propaganda in our newspapers anymore." A middle-aged woman who had worked as a translator in New York and

London volunteered her great admiration for British tolerance, adding that she believed the best society to be one in which men and women have free access to every point of view. Thereafter she vehemently maintained that the Soviet Union enjoys far more freedom of speech than does the United States, and she stubbornly insisted that Soviet people may read anything they choose.

I asked certain questions repeatedly, trying them out at every opportunity. The answers were essentially the same.

"Was the trouble in Hungary a counter-revolution?" "Of course it was. Counter-revolution provoked by agents of the fascist forces in the United States."

"Did the Soviet army in Hungary act as a revolutionary force or as a counter-revolutionary force when it suppressed the workers?" "The Soviet army is a revolutionary army."

"If the Soviet action in Hungary was correct, why did the United Nations condemn it?" "Everyone knows that the United States terrorizes the smaller nations or buys their votes with dollars."

"And why were the only countries voting against the United Nations' condemnation, communist countries?" "The communist peoples are peace-loving peoples."

Then the counter-questions would begin: "If America really wants peace and friendship, why don't you send your delegates to our peace conferences? Why didn't you send more young people to our Youth Festival? Why do you surround Russia with air bases? Why do your leaders want war?" Only rarely were such questions asked with deliberately provocative intent. Rather they were put by disturbed and credulous people who suffered all the horrors of military destruction during World War II. According to figures which the people in Stalingrad frequently quoted, 85 per cent of Stalingrad was leveled by the fighting; Rostov's citizens spoke of losing 70 per cent of their city; at Kiev it was 40 per cent. Other reliable statistics present staggering figures that spell

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vast ruin to libraries, livestock, industries, housing, and lives. The Soviet people are frantic for peace, but they appear to believe that America lives for war. Underlining her deep concern, and putting her worries into physiological terms, a guide told me sadly, "Every time I eat too much watermelon I dream about atomic bombs."

How does one explain to the friendly people that the party they trust so completely wants power more than peace, that it refuses to consider the problems of peace with good will or justice, that it strives always, tongue in cheek, to persuade the world that wrong is right and black is white? How can one convince the man-in-the-street that Khrushchev's rule embodies all the elements of Stalin's tyrannical regime? How can the West counter the overwhelming effects of the near-absolute control of communications that has saturated the Soviet atmosphere with the communist story for forty years? How can we persuade two hundred and fourteen million people who have spent their lives in a giant isolation ward, that the world outside is not in the grip of blood-thirsty moneybags and military ogres?

Our problem, I believe, is rendered especially difficult by the Soviet citizen's positive personal confidence, created at least in part by his isolation and ignorance. Repeatedly I was struck by a lack of mental resilience of the sort one normally expects to find in educated, reasonably sophisticated people. Presumably an educated man in Western society knows quite well that other men hold views unlike his own. He understands that he must listen to other opinions, consider them, adapt himself to them if they bear up under criticism, or reject them when they are proved erroneous. To continue to live as an educated man, he must learn what the rest of the world thinks, if only to clarify his own position in the world. The Russians I met appeared to have little or no adjustment mechanism for new ideas. They were certain they knew the whole truth. When faced with a fact or theory which ques-

tioned their truth and which could not be ignored, their automatic reaction was anger and resistance. An atheistic young lady who accompanied me through a monastery quickly lost all control before the symbols of religious worship and growled with fury at the courteous monk who guided us. Later she explained to me that her country has no room for religious nonsense. While hotly insisting that complete religious tolerance exists in the Soviet Union, she held forth on the stupidity and backwardness of people who worship God. Most of all, she feared that foreign visitors might get the wrong impression of Russia; we might go away thinking many Russians are religious, "when the truth is that only the old people believe." I tried to explain that for the historian the Orthodox faith has immense interest as a predominant factor in Russia's culture from the 10th century to the 20th. She listened, appeared to consider the point, and finally blurted out a denial even of the church's historical importance.

When, to older and wiser persons, I suggested the errors of one or another standard Soviet explanation of international affairs, my criticisms were politely but firmly turned aside. The party knows the truth; the prophets lay down the true line according to Marxist-Leninist gospel; all other truths are false and must be attacked. This refusal to consider alternative theories, this automatic defense of the party line, was exhibited most ferociously by the intellectuals. Western scholars believe that the Soviet Union's more trusted and mature scholars may examine archives not open to younger students or to the general public. Possibly such men have access to all party, government, secret police, and military records; therefore, they must possess solid, objective knowledge of the Soviet past and of international affairs. However, it was not my good fortune to meet such men, or if I met them, their objectivity was not apparent. My conversations with distinguished historical scholars and with

academicians who specialize in the study of foreign areas led me to believe them to be motivated by a positive determination to view all information through communist glasses. As for those who cannot be trusted always to see white for black and false for true, works telling the wrong story are simply not available. In the catalogues of the great libraries at Leningrad, Moscow, and Kiev, many important documentary collections and memoirs of significant men are strangely but systematically missing. The great men of the party who were purged by Stalin remain purged; their valuable publications are *verboten*.

In sum, whether because of ignorance of the possibilities of human life, because of a party-conditioned inability to see the other side of things, or because of enlightened and considered conviction, the Soviet people I talked with were disconcertingly well-satisfied with their lot. They exhibited great faith in the party and in the social and political systems it has created.

IV

The way conversations foundered on the rocks of Russian political blindness and total ignorance of the non-communist world was for me the most depressing impression of my journey. Isolation and the concomitant abject and absolute faith these people displayed for leaders and party have a dreadful significance. If we cannot get through to help the Russian people understand us, what chance have we of avoiding the holocaust Soviet theorists consider inevitable? If there were among these people some inkling of the existence of facts they do not know, some awareness of gaps in their knowledge, then we might hope to win them to an acceptance of the idea that there can be more than one legitimate interpretation of the truth. If we could obtain a hearing from the millions of Russians, perhaps in time we might persuade them to consider us not the new Huns but men of good will.

Unfortunately we have not yet devised effective techniques for penetrating the mental curtain. Clearly, there is no reason for believing that the pressures of our State Department and of United Nations' debates will ever persuade the communist leaders to view our side of the story sympathetically. Neither argument nor threat of violence from our side will persuade the party elite that there may be some elements of fairness in our disarmament proposals, of justice in our stands on Hungary and Poland, of good will in our policy towards the Middle East. The central and essential communist precept is that we are the enemy, and nothing indicates that this attitude of the party will be changed by normal diplomatic procedures.

We may hope that if we continue with patience and resolution, time will aid us. Although the historian is quite sure that the future cannot be predicted and that the completely unforeseen may always happen, those who do predict believe time may be on our side. The Soviet system, some argue, having developed too rapidly, is taut with dangerous stresses. Postwar expansions and the consequent administrative strains may eventually lead to the collapse that often comes to overextended empires. Another hopeful theory sees yesterday's primitive Russia changed into a highly-educated society in which the managerial and professional classes may already have become too rational and powerful to go on bowing before the anti-rational principles of party doctrine. Supporters of this theory and others similar to it anticipate an erosion of party dictatorship toward a genuinely constitutional order. But the waves of internal criticism needed to grind down the party leaders by verbal attrition have not yet appeared, and today the responsible ministers, generals, and industrialists—though communists—are not irrational. They are, on the contrary, the best-trained, the most competent and intelligent men in their society. Still another hope is that the coming rise of China and India to great-power status will end the

East-West deadlock and rearrange political alignments around the world. Perhaps the Chinese will draw Soviet hatred away from us when they more aggressively challenge Russia's leadership of the communist world. The dangers if we rely on this hope are twofold: just as it is impossible to tell whether future alignments will favor us, so also we have no guarantee that we shall be allowed to enjoy peace until industrialization transforms China and India into great powers.

In Russia today the party's word is unquestioned truth for most Soviet people, and the party will fight desperately to keep things this way. Should internal dissension reach great proportions, the party may be expected to hold its position stubbornly, even to a declaration of war against its own people in the form of suppressions and purges. On the international scene, the situation spells continued diplomatic, economic, and ideological warfare that will be pushed with intense determination by the Soviet leaders. Sooner or later, of course, desperation or the belief that they can win the world without ruinous harm to themselves may push them into war.

In the face of this grim situation, we cannot simply fold our hands and pray that the future may save us. Something must be done, if only because we persist in believing in man's ability to solve at least some of his major problems. But what? Given the friendly people, their confidence in the party, and the character of that party, I see only one promising new line of action that might aid our present policies. I offer it here, not as a pat panacea, but as a course of action that might help us to move a step or two in the right direction.

We must devise methods that will penetrate the Russian mental barrier in a thousand places. Somehow we must carry our views through the iron curtain often enough and effectively enough to break the intellectual monopoly of the party and thus help the Soviet people to consider all sides of the truth. We face the gigantic task of changing the intellectual atmosphere of a great nation before the present climate of

opinion in that nation becomes the weapon of our destruction. We have the means of such penetration in the ubiquitous American traveler, in the professors and students who willingly spend years of their lives in foreign areas. If greater numbers of our people, particularly those in the scholarly, scientific, and business fields could be persuaded to visit Russia, I believe that the personal, face-to-face contact of American with Russian would be of inestimable benefit to our side. If our American travelers were prepared to speak in the Russian tongue, and to discuss Soviet affairs with some degree of competence, the chances for successful exchange of ideas would be immeasurably enhanced. The Russians need to see the American, to watch him talk and think; they need the living example to prove that the theories they hold demand reconsideration; they need the opportunity to find out for themselves, on a street corner or in a private home, how this foreigner thinks and what he thinks with.

Obviously, expanded exchange relationships should not be expected to teach the Soviet people to love us or want to transform the Soviet Union into another United States. Indeed our efforts will be stillborn if we approach this task with the narrowly provincial view, far too prevalent among us, that the United States is the one thoroughly civilized nation in the world and that if the Russians had good sense they would try very hard to be like us. The Soviet culture is not a recently and synthetically created communist gimcrack but the sum of Russia's historical experience. The typical Soviet man is neither a murderous Cossack nor a fanatic party member; he is a hard-pressed man who loves his country, its traditions and arts, and who thrills to its economic and scientific accomplishments. That he also has some patterns of taste and conduct, some articles of faith unlike our own does not mean he is inferior to us. Quite the contrary may be, and often is, true; therefore we cannot presume to do all the teaching; we must be willing to admit that more than one kind of human

truth exists on this globe; and we must be prepared to learn. This is not a plea that we try to understand communism better; we comprehend communist ideology and practice quite well enough to condemn it. But we do need to make every effort to work out ways of living in this world with the *people* of the Soviet Union. Though they may not value us as we value ourselves, it is quite possible that we may find points of agreement with them, enough perhaps to lay the specter of war for another decade or two.

Together with a genuinely massive travel effort, we should do all that can be done to bring more Soviet people to the United States, as students, professors, and tourists, and as industrial, agricultural, and other delegations. In addition to breaking down some of our own queer prejudices and helping us to learn the Soviet citizens' views, such exchange practices could have invaluable influence upon our visitors. By enabling a great number of Soviet men and women to escape their own isolation and to see more than they have been allowed to see, we would be compelling them to reconsider what they have been taught; and if a sufficiently large number of the present-day elite (the well-educated 8,000,000) could be reached, the effect of a Soviet-style "agonizing reappraisal" might have profound influence upon the policies of party leaders. Though these leaders are the heads of a totalitarian state, they are not insensitive to their people's demands; the channels of command and information run both ways, and every current Big Brother keeps his ear pressed to the ground to sense those public moods that are too strong to quell.

In the agreement to encourage cultural exchange signed by representatives of our State Department and the Soviet Ambassador on January 27 of this year, a small but promising new opportunity for action has appeared. The agreement is but a preliminary step; its significance depends upon the willingness of individuals, universities and colleges, and other

organizations to establish direct relations with their counterparts in the Soviet Union and, where possible, to develop mutually-acceptable exchange policies. A great deal of private initiative, imagination, and resourcefulness is called for if the present opportunities are to be exploited effectively, and much constructive leadership must come from the university communities of this country.

If vastly extended tourism and systematically expanded exchange programs at the educational, scientific, and business levels were combined with intelligent efforts to make the best possible use of our modern knowledge of international communications techniques for the purpose of selecting the messages to be conveyed and the best means of transmitting them, the Soviet mental barrier could be broken down. Though the difficulties of initiating and wisely executing such programs will be great, and though the promise of success is tenuous, the challenge is too great to ignore. Even a small hope is better than no hope at all.

PSYCHOANALYSIS AND CULTURE

Jack J. Preiss

THE INFLUENCE of Freudian psychology upon thought and practice in all of the social sciences has been widespread. In the field of cultural anthropology the influence manifests itself in two basic assumptions. The first is that the individual and the group are interdependent in nearly all significant behavior patterns. The second is that meaningful interpretations of these patterns depend upon examinations of theory and research not merely in one but in several fields. It should be noted at the outset that this point of view of interdependence, despite its importance, constitutes only one orientation in psychoanalysis and in anthropology, and that consequently it is not necessarily representative of or acceptable to all workers in either field. Nevertheless, these assumptions *can* serve to focus our attention on several conceptual and operational factors which have produced considerable disciplinary interaction.

I

Turning briefly to the psychoanalytic position, we find that Freud's notion of culture was, even by current standards, rather diffuse. He made no systematic distinctions among the concepts of "culture," "society," "institutions," and so on, but was inclined to lump them all into a sponge concept represented by "environment"—a constellation of outside influences impinging upon the individual. Freud felt that this environment, particularly its social aspects, generates a constricting effect upon normal (physical) maturation, leading to interference with the process of proper heterosexual iden-

tification and expression (libido development). As a result of this interference, early emotional conflicts and ambivalences are set up in the individual personality which may produce neurotic or psychotic behavior in later life. Essentially, then, these external forces are depicted by Freud as negative influences. They are epitomized by the concept of "super-ego" which, to use Mullahy's assessment of Freud's meaning, "dominates the ego [the modified id] and operates with severity and cruelty."¹

Freud's major attempt to deal with anthropological material was in *Totem and Taboo*. Here he tried, chiefly by analogy and inference, to show similarities between the so-called primitive savage and the obsessional neurotic of western society. He was able to make this attempt because fundamentally he considered non-literate societies to be actually simple, unsophisticated, and childlike in terms of social organization and level of emotional maturity. This assumption, of course, ignored the fact that segments of many of these societies are more complex and highly developed than our own. Such comparisons between non-literate man and modern western man, as expressed by so-called "stage" theories of human development, have largely been abandoned by anthropologists. Thus the Freudian savage may no more be regarded as the equivalent of the Western neurotic than the Negro as the inherent intellectual inferior of the white man. Without discussing *Totem and Taboo* in any detail, one may point out that although Freud uttered words of caution about the use of analogy as a method of investigation, he himself relied heavily upon analogical projections. Thus, in all societies the Oedipus complex is assumed to be at the genesis of those guilt feelings which are the foundation of neuroses. His principal anthropological sources were Frazer, Wundt, and Reinach, who were utilized primarily as suppliers of de-

¹ Patrick Mullahy, *Oedipus: Myth and Complex* (New York: Grove Press, 1955), p. 39.

scriptive data rather than of theoretical ideas. But those upon whom he relied most heavily have not retained their prominence in anthropology. This circumstance, however, is a historical development rather than a deficiency of Freud, since he could do no more than make use of available authorities.

Although his excursion into comparative cultural analysis was open to early criticism,² Freud's theories and the controversies over them attracted increasing attention among social scientists. In the 1920's and 1930's, anthropologists such as Malinowski, Benedict, Mead, Sapir,³ and others began to see, or imagined they saw, in several of Freud's dynamic concepts a frame of reference which could be adapted to the variability of their field observations. For example, Freud's contention that much human behavior is unconsciously motivated opened a vast new arena for interpreting ethnological data. Using this motivational concept, a covert symbolic system could be presumed to underlie the perceived components of a culture. Consequently the plethora of tribal customs, rituals, and kinship organizations took on fresh significance, and could be viewed as a network of defenses, repressions, and sublimations stemming from the emotional conflicts engendered by the culture. Rather than looking at a society as a complex of institutions, devoid of personality factors and variations, more attention was paid to the processes of individual development in the cultural context being studied. Such a phenomenon as magic came to be regarded not as a religious or social artifact, but as a technique used by persons in the society for solving problems and for mitigating insecurity. Frequently, of course, these functions of cultural elements were not recognized as such by those who actually utilized

² As in A. L. Kroeber, "Totem and Taboo: An Ethnological Psychoanalysis," *American Anthropologist*, 22, 48-55 (1920).

³ For example, Bronislaw Malinowski, *Sex and Repression in Savage Society* (New York, 1927); Ruth Benedict, *Patterns of Culture* (New York, 1934); Margaret Mead, *Sex and Temperament* (New York, 1935); Edward Sapir, "The Emergence of the Concept of Personality in the Study of Cultures," *Journal of Social Psychology*, 5, 408-15 (1934).

them, and therefore had to be "discovered" by the observer. As Kluckhohn has indicated,⁴ greater research emphasis upon life histories and developmental processes produced changes both in field methods and in the format of published anthropological reports. One can appreciate what attraction this added frame of reference had for those empiricists formerly limited by static conceptions of rationality and logic. Thus the dynamic Freudian system attracted those social scientists who were becoming more concerned with process rather than structure, with mobility and change rather than stability of form.

Although the early stages of disciplinary interaction found the anthropologists mostly on the receiving end, there was concurrent movement in the other direction as well. Freud's ideas, in turn, began to be re-examined in light of improved social and cultural data. Among these was the assumed universality of the Oedipus complex (sometimes called Electra complex in females), in which every child becomes the rival of the parent of the same sex for the physical possession of the other parent, as a phase of sexual maturation. This rivalry, Freud believed, was eventually repressed through guilt feelings and was driven into the unconscious, though it often reappeared symbolically in neuroses and other emotional conflicts. Social scientists have suggested that the term "guilt feelings" is an acquired rather than an inherent characteristic. Accordingly, any guilt stemming from sexual activity or its blockage must be considered a phenomenon separate from the sex drive itself. Guilt, then, is a social concept, whereas the sex drive may be assumed to have a biological genesis. People can only *learn* to feel guilty, and the objects of guilt are not invariable in all societies. A child, for example, can have attitudinal feelings toward parents only if they are so-

⁴ Clyde Kluckhohn, "The Influence of Psychiatry on Anthropology in America During the Past One Hundred Years," in J. K. Hall, G. Zilboorg, and H. A. Bunker, ed., *One Hundred Years of American Psychiatry* (New York, 1944), pp. 589-617.

cially significant in his life and not simply because they are parents in a procreative sense. Furthermore, one may ask, does a male child brought up almost entirely by women really develop an Oedipus complex? Certainly Freud's suggestion of the phylogenetic memory of the primal horde as being responsible for feelings of guilt and fear seems beyond empirical observation and presumes a type of acquired characteristic which at present is genetically undemonstrable.

Another tenet which received critical attention was Freud's emphasis upon early childhood experience as the major determinant of adult personality. This emphasis accounted for the psychoanalysts' intense interest in a patient's feelings and relationships with parents and siblings; every adult trait and behavior pattern presumably could be traced to some of these early experiences. Nevertheless, though it is quite certain that the first five years of life have tremendous significance for initial personality structure, this is not sufficient reason to deny that later periods can foster *substantial* alterations in such structure. The direct and less socialized needs of the child (food, sleep, etc.) do not disappear, but their position becomes less central in the total personality as the individual matures. Socially acquired needs and motivations, it may be maintained, are important in their own right and are not necessarily extensions of basic biological drives, as Freud would have contended.

II

The psychoanalysts' central concern with the uniqueness of an individual's "special" pattern of personality seems to stem from a basically clinical orientation. In this situation, the patient himself is the primary source of data, and the social and cultural background in which he lives and moves is often only dimly seen. The patient's singular problems are considered paramount, and each case has, in a way, to be fought and won as a special campaign. With such a preoccupation, the

early Freudians, particularly, felt that the individual was microcosmic, and that only by accumulating evidence from detailed case studies of the "private" life of patients could the riddles and ambivalences of general behavior be solved. Modern social scientists, however, regard this clinicalism as valuable but limited, and they point out that close attention to "abnormality" can only give an *inference* of "normality," since both concepts must necessarily be elucidated if either is to be meaningful. So far, biology has not supplied sufficient grounds for a definition of normality in the broad behavioral sense. Even the so-called biological "drives" themselves are always modified by situational factors. No one has ever observed an instance of unrestrained libidinal development as a purely biological process. For such reasons, any kind of biological reductionism now seems misleading when it emphasizes one indispensable ingredient in behavior, while basing this emphasis upon culturally limited clinical observations.

In this vein, questions have been raised as to why some groups and societies contain only certain types of pathology, as they are defined by current clinical categories. Devereux,⁵ for instance, has claimed that schizophrenic syndromes were practically absent in several African tribes, although other mental disorders were discernible. In modern Western society, by contrast, schizophrenia and its derivatives currently account for the majority of diagnosed psychoses in our mental hospitals. Kardiner and Linton's analysis of Comanche culture⁶ indicated that *any* kind of neurotic or psychotic is likely to be rare in a culture which provides its members with accessible channels for relating themselves to the group and to each other. In such a culture there would be high integration between group ideals and goals and the means available to group members for achieving them. Personality

⁵ George Devereux, "A Sociological Theory of Schizophrenia," *Psychoanalytic Review*, 26, 315-42 (1939).

⁶ Abram Kardiner, *The Psychological Frontiers of Society* (New York, 1945).

conflicts would therefore not arise because of discontinuities in expectations or frustrations in achieving objectives. Evidently the variations of this sort among groups and societies are not accidental, although in itself the fact that culture or civilization influences biogenetic development does not sufficiently explain *how* this influence operates nor of its consequences.

In the light of these and other findings of social science concerning the relation of culture to social and psychological behavior, a number of psychoanalysts have introduced new ideas into the original Freudian system. These new ideas have focussed principally upon the etiology or development patterns of neuroses and psychoses, rather than upon the clinical methods of treating them. Erich Fromm, for instance, has seen the neurotic problems of modern Western man more in terms of social than of sexual conflict. This is not to deny that sexual conflict is often crucial in producing a neurosis, but rather to suggest that not all conflict is reducible to sexual referents. Fromm also added a provocative social dimension to the concept of neurosis through what he termed the "socially patterned defect."⁷ He has suggested that when a neurosis becomes sufficiently widespread in a society it no longer can be considered a neurosis in the orthodox sense, but becomes instead a part of culturally approved behavior. The society itself may therefore have neurotic features which would be quite normal for persons functioning within it. In this view, deviancy and abnormality become social variables, which depend upon the relative prevalence of various behavior patterns, and which account for what Fromm called the "pathology of normalcy." By a similar approach, Karen Horney sought to define the major cultural dilemmas and ideological contradictions which engender hostility and insecurity within a society.⁸ Thus, a high frequency of certain

⁷ Erich Fromm, "Origins of Neurosis," *American Sociological Review*, 9, 380-384 (1944).

⁸ Karen Horney, *New Ways in Psychoanalysis* (New York, 1939).

types of neuroses and psychoses would give clues to the kind of pathological environment under which people live. The analyst like Horney would thereby be inclined toward a psycho-social evaluation of "normality" rather than a bio-medical one. And so we find among some Freudian revisionists a deep concern with culture, not solely as an inhibitor of biological drives but as a primary locus of satisfaction and tension in its own right. The neo-Freudian etiology of neurosis is accordingly much more inclusive than Freud's original formulation.

From the foregoing, we can see that psychoanalysis and anthropology have been regularly utilizing and modifying each other's points of view and data. Sometimes this has resulted in active collaboration, of which perhaps the best known instance is the work mentioned above, of Kardiner and Linton, a psychoanalyst and anthropologist respectively, who carried out joint investigations of non-literate cultures. One major outcome of this collaboration was the creation of a theoretical construct which could be used to delineate the essential personality features within a social system. In one sense, this construct resembled such philosophically ideal types as "rational man" and "economic man" which were in great vogue during the 18th and 19th centuries. However, it had additionally a much clearer empirical base than these earlier types, as well as fewer moralistic overtones. Essentially, Kardiner and Linton tried to establish a technique for studying reciprocal relations between culture and personality, and also to furnish a reliable critique of cultural forms, in terms of whether they were healthy or unhealthy in a psychotherapeutic sense. The operational means for achieving this in a particular culture revolved around: (1) the adoption of a Freudian frame of reference as an analytical device, (2) the employment of various projective techniques, such as the Rorschach and the Thematic Apperception Test, to characterize sample personalities, and (3) the attempt to

account for resultant profiles in terms of cultural and social facts supplied by the anthropologist. The product of these procedures was called a "basic" or "modal" personality type which could be said to exemplify the "normal" person for that society. This basic personality structure was not a fixed or narrow concept, but rather a behavioral range or continuum which could allow for some individual differences.

"The "normal" person was thus a composite of the most prevalent kinds of behavior patterns which could be defined. While no precise lines could be drawn separating "normal" and "abnormal," this construct offered an approach to behavior which took account of the mores and ideologies of each society. No effort was made by the researchers to praise or condemn characteristics in an ethical sense, yet comparisons with Western value systems could readily be drawn if one so desired. One problem raised by this method is that the image or profile created may often be taken either as an ideal to be achieved or as a replica of actual persons. As indicated, it is neither, although it must certainly mirror many values of the society and correspond to the behavior of most individuals therein.

In the wake of this approach, as applied to relatively simple cultures, came a number of studies by others, such as Gorer, Riesman, and Brickner,⁹ which purported to establish similar configurations of social or national character in Western society. Many of these efforts, particularly those of Gorer and Brickner, engaged in considerable speculation, both in analyzing what data were uncovered and by making moralistic evaluations about the conduct of the groups being investigated. Gorer, for instance, assumed a critical attitude toward American values in terms of what he considered their artificiality. He saw Americans as being so desirous of approval that they were willing to sacrifice integrity to gain it.

⁹ Geoffrey Gorer, *The American People* (New York: Norton, 1948); David Riesman, *The Lonely Crowd* (New Haven: Yale University Press, 1950); R. M. Brickner, *Is Germany Incurable?* (Philadelphia, 1943).

Likewise, he made allusions to certain habits such as the widespread drinking of milk by male adults as being a reflection of breast fixation as a sexual symbol. Brickner, in describing the "basic" German as a compulsive-obsessive individual, attributed the political and military history of Germany to these supposedly inbred traits. Without doubt this type of cultural analysis has indulged in somewhat oversimplified characterizations of complex societies and has applied Freudian concepts with considerable abandon.

Along parallel lines, the work of the psychiatrists Sullivan and White¹⁰ should be mentioned as constituting a new approach on the clinical level, which has come to be known loosely as "social psychiatry," being predicated on the primacy of man's social experience as the keystone of personality development. Culture *per se* is less influential in such development than are the processes of face-to-face group relations. Sullivan, in particular, is concerned with how *people interact*, rather than how *a person acts*. The "self" is not a single image but a composite of the images a person conceives others to have of him. These "others" are therefore crucial to any theory of personality, since no one can formulate a "self" except by responding to images and expectations which he derives from those around him. Group relations give rise to functionally applicable standards of interpersonal competence, as a measure of personality adjustment. A symptom such as anxiety, then, would stem less from sexual malfunction or from failure to achieve cultural goals, and more from a person's inability to communicate with and respond to significant "others" in social groups. For these reasons, in the treatment of mental illness some psychiatrists are paying a good deal of attention to the situational contexts in which the individual functions, as well as to his cultural identification.

¹⁰ Harry S. Sullivan, *Conceptions of Modern Psychiatry* (New York, 1940); William A. White, *Outlines of Psychiatry* (14th ed., New York, 1935).

III

We have seen in this brief resume that the relationships between psychoanalysis and cultural anthropology have been considerable and have had material effect upon theory and practice in both fields. At the present time we cannot ascertain the ultimate value of these relationships. To some purists in both disciplines, this exchange of information and techniques contaminates each. Considerable ire can still be aroused in scientific circles by the mere suggestion that one group of investigators can or should learn from another.

But even granting the legitimacy of interdisciplinary co-operation, many substantive problems remain. Obviously, one key question concerns the validity of transposing Freudian characterology from its largely clinical, therapeutic context to an entirely different application, such as the basic personality construct. Even if this could be achieved for relatively small homogeneous groups, could we ever agree upon one basic personality—or even a baker's dozen—in mobile, diversified societies? Efforts to do this to date, although suggestive of thematic cultural characteristics, are frequently undefinitive and amorphous.¹¹

Another crucial question involves the acceptability of the Freudian system and its variations as *science*. Here, as might be expected, we have strongly opposing positions. Many social scientists feel that neither the system nor its proponents has been amenable to the employment of the quantitative research tools developed in recent years.¹² They insist that

¹¹ There are notable exceptions, particularly Hallowell's attempts to synthesize the data gathered about the Ojibwa Indians in terms of a conceptual scheme and by using some precision techniques for analysis. However, he does rely heavily on clinical-type instruments, such as Rorschach, to produce raw data. See A. Irving Hallowell, *Culture and Experience* (Philadelphia: University of Pennsylvania Press, 1956).

¹² Some students of culture and personality, both psychoanalysts and anthropologists, specifically "reject" statistics as a means of discovering shared culture, e.g., Erich Fromm, "Psychoanalytic Characterology and its Application to the Understanding of Culture" in *Culture and Personality*, S. S. Sargent and M. W. Smith, ed. (New York: Viking Fund, 1949), p. 10.

unless we can translate essential psychoanalytic concepts into testable hypotheses and a coherent logical chain of propositions, such concepts can never achieve scientific credence. If we subscribe to the postulates of positivistic science (and there is no compulsion that we must), it can be frankly admitted that the empirical validation of psychoanalysis has not yet occurred. We have myriads of recorded case histories, intuitions, and insights, but these have not yet been assessed adequately by any scientific process. Furthermore, on methodological grounds there are a number of questionable practices in Freud's own methodology which have persisted in the work of many of his successors. For example: (1) a tendency to generalize from the single case, or a few cases, derived from personal experience (a common clinical practice in many fields); (2) using *ex post facto* explanations (interpreting data via preordained categories); (3) a reification of concepts (e.g., subjectification of id, ego, super-ego); (4) an extensive use of analogy as proof (e.g., capitalism's goals equated with individual oral needs); and (5) an ambiguous definition of key terms (e.g., ego, sublimation, etc.).

At the other pole are those who feel that from the beginning psychoanalysis has *always* been a science, and more recently even a metascience.¹³ From this stand, all history might be viewed as one continuous effort of mankind to compensate for the external restrictions upon its impulses. For such disciplines, Freud provides the major keys to an understanding of all human behavior, and for them his concepts are beyond or above the canons of science. For the faithful, psychoanalysis generates the charismatic flavor of an ultimate gospel.

Between these extremes of acceptance and rejection, the status of culture and personality research oscillates. In one group, for instance, we can distinguish a return to something like psychoanalytic orthodoxy, as contrasted with the neo-

¹³ See G. E. Wilbur and W. Muensterberger, ed., *Psychoanalysis and Culture* (New York: International Universities Press, Inc., 1949), p. ix.

Freudian position. These "re-Freudians," or "institutional" Freudians¹⁴ preserve the original etiological theory of neurosis, which Fromm and others modified. Yet they give a definitive role to social environment as a contributive factor in determining the expressive form of neurosis, though not in its genesis.

At the same time, a movement has developed in social psychology which seeks to amplify the work of Sullivan and Kurt Lewin¹⁵ into a general field theory of behavior. This approach places the locus of personality in the dynamic atmosphere of group *intra*action, and is an attempt to link psychiatry and Gestalt psychology with sociology. The whole person is seen as a functioning part of a group setting which molds and influences him in an observable manner. Researchers¹⁶ have placed particular emphasis upon such problems as leader-selection and decision-making in small groups. For example, Bales set up a series of experimental situations involving up to ten persons who were given problems to be solved in an unstructured group situation.¹⁷ The efforts and struggles of the group to organize itself and complete its tasks were recorded and classified in a system of observation categories. Through this and similar experiments, much has been learned about how groups strive for and maintain stability.

In addition to these efforts, the whole "spirit" of psychoanalysis as a cultural phenomenon needs clarification. Seen in its own historical perspective, the Freudian movement can be regarded as one response to the traumas of living in middle-class Western democracy. As such, it prescribes remedies

¹⁴ H. Hartman, E. Kris, and R. M. Loewenstein, "Some Comments on Culture and Personality," *ibid.*, pp. 3-21.

¹⁵ Kurt Lewin, *Field Theory in Social Science* (New York: Harper, 1951).

¹⁶ See, for example, D. Cartwright and A. Zander, ed., *Group Dynamics: Research and Theory* (Chicago: Row, Peterson, 1953).

¹⁷ For a description of method see Robert F. Bales, *Interaction Process Analysis, A Method for the Study of Small Groups* (Cambridge, Mass.: Addison-Wesley Press, 1950).

for those ills of self-abnegation, fears of failure, compulsive goal-seeking, etc., which are most common in such a cultural environment. These remedies generally take the form of a reorganization of personality in terms of (1) an adjustment to the situational *status quo*, and (2) self-reorientation based on acceptance of one's own liabilities as well as assets. Psychotherapy aims generally to help the patient establish an orientation to life which will enable him to "get along" in his social milieu without dysfunctional results. This clinical operation has important implications for any society which accepts psychotherapy as a legitimate form of treatment.

Eventually there must be decisions on some levels of opinion or authority as to whether the treatment produces a desirable sort of "well-ness." No precise standard exists for judging socially acceptable behavior, other than the "cultural normality" principle, which remains a sponge concept. In other words, should we not ask whether psychoanalytic treatment produces the kind of personal adjustment which is most productive to the society in the long run? After all, many societies have existed and thrived without it, just as they have done with feeble technologies and with a variety of types of family organization.

The problem on this level becomes, perhaps, less one of techniques and more one of philosophy. Psychoanalytic treatment often appears to function adequately, once certain goals and situational factors have been postulated. However, the establishment of general social goals and the definition of optimum behavioral situations are matters which clinical psychoanalysis usually seeks to avoid, even though these factors have much influence upon individual motivation. Thus while social scientists have long emphasized the role of social process in affecting behavior, most psychoanalysts have almost pointedly neglected the phenomenon of change, except as it applies to an inherent bio-physical cycle of maturation. Therefore, in a philosophical sense, Freud's

approach, for all its emphasis on dynamism, comes through as a deterministic and almost fatalistic system. There is a resultant tendency to transfer this determinism to the patient under the rubric of "adjustment." In Western culture, this adjustive brand of realism may give solace to a turbid soul, but at the same time it may discourage creative vitality and critical effort in the society as a whole.

This discussion has not been intended to resolve the problem of evaluating psychoanalysis in terms of its cultural ramifications, but rather to pose the problem itself as requiring some solution. There are many other positions and considerations which cannot be discussed here, but it is sufficient to note that the current situation in culture and personality research reflects considerable variety as well as ambiguity. Nevertheless, such research has the commanding virtue of compelling investigators to focus on human behavior as a multi-dimensional phenomenon. If nothing else has resulted from all that has been done and said so far, there is now general agreement that unilateral explanations of behavior simply will not do. Parsons has suggested that sociologists and anthropologists must face the problem of human motivation whether they want to or not. If they do not acquire a genuinely competent theory of motivation they will implicitly adopt a series of *ad hoc* ideas which, though exempt from critical analysis, remain crucial for behavioral theory.¹⁸

Most of the fundamental theoretical and research tasks in the behavioral sciences are still to be undertaken. It appears likely that if any unified theory of human action is ever achieved, whether scientific or not, it will be indebted to—or perhaps be a direct continuation of—the type of disciplinary interaction which has been sketched here.

¹⁸ For general discussion of this point see Talcott Parsons, *The Social System* (Glencoe, Ill.: The Free Press, 1951), pp. 29-33, 36-45.